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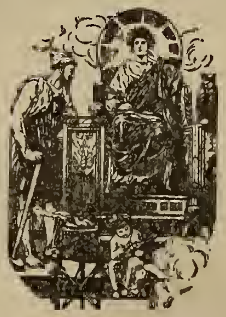

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THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

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HOROLOGY.

(*Continued from page* 290.)

XXV.—On the Measurement of Time.

"As we have already stated, watches were not invented with a view to a more perfect division of time or to aid scientific researches, but simply to supply a commodity of life which the progress of civilization demanded. The watches of the sixteenth century are found in the hands of princes and courtiers and not of scientific men. No doubt they had handsome and richly ornamented cases, but their movements lacked the precision which is so essential in our time. Nor could any more be expected from a watch with a balance deprived of a spiral, with nothing to compensate the diminution of force to which the spring-motor was liable in unbending itself, and with a barrel moving the remainder of the wheelwork by means of catgut, a body very much influenced by atmospheric changes. It was, probably, towards the end of the sixteenth or the commencement of the seventeenth century that the last two of these defects were overcome; the one by the ingenious invention of the fuzee, which makes the spring act on a lever lengthening in the same ratio as the force diminishes, and the second by the employment of the chain instead of the cord. It has not been ascertained to whom these improvements are due, nor is the exact time of their introduction known.

"In the sixteenth century, or even before, it began to be understood that these time-measuring machines, until then only used in civil life, could also render important services to astronomy. The Germans bestowed such care on their construction, that they produced as perfect a time-keeper as the limited knowledge of horology in those days permitted. Some of their clocks marked even minutes and seconds, and to *Walther, of Nüremberg*, who lived about the end of the fifteenth century, is attributed the first use of a clock for measuring the time during an astronomical observation. Eighty years later the celebrated *Tycho Brahé* used several of them for a similar purpose. But the colossal dimensions of these machines, and the enormous friction to which they must have been subject, rendered them insufficient for such delicate operations. Scientific observation, which now began to develop itself, could not be satisfied any longer with such an imperfect subdivision of time; the moment had arrived when theory should outrun practice, a characteristic of the horological inventions of the seventeenth century.

"The honour of having opened a career of greater exactitude to horology may be accorded to Galileo, as the discoverer of the laws which govern the movements of the pendulum. It is said of this ingenious man that he was already acquainted with *isochronismé* in his youth, having observed in church that the oscillations of suspended lamps were of uniform durations. At the close of the sixteenth century he employed the pendulum in all its simplicity as a counter in his experiments on the fall of bodies, and, perhaps, also in some of his astronomical observations. *Riccioli*, *Mersenne*, *Hévélius*, and several other astronomers imitated him. The oscillations of a pendulum, apparently of equal intervals when describing a small arc, offered a far more exact subdivision of time than the best balance-clock then existing. In the latter days of his life, Galileo, who was then assisted by his son, applied a wheelwork to an oscillating pendulum, which indicated for some time and with greater convenience to the observer, the equal intervals of the movement of apparatus; yet, the more simple idea of replacing the balance by the pendulum in the existing clocks did not strike him. The illustrious geometrician had already gathered his full measure of glory, and the honour of making the happy application of the pendulum to clocks was reserved for one of his successors. Some authorities attribute it to a Swiss, *Tuste Byrge*, a clever astronomer and mechanician, born at Lichtensteig (Canton St. Gall), but his claims are rather obscure, and we must give the palm to whom it is really due, to the famous Huyghens.

"Up to this time the balance served no other purpose than to oppose its inertness to the movement of the wheelwork, imparted by weight or spring; a movement which, without it, would have accelerated and gained a rapidity incompatible with the object of the mechanism. The balance was brought back alternately by the teeth of the balance-wheel catching, one after another, the two pallets on the axis of the balance, and so caused the apparently equal stoppages, regulating the movement. But there was nothing very perfect in this regularity, because the regulating balance received all its impulsions from the motor of the clock and had no principle of isochronisme whatever in itself. Supposing the regulator provided with the principle of an oscillatory and isochronous movement, the wheelwork would only obey the action of the motive power at each of the uniform vibrations of the regulator, and the latter would receive from this force the necessary impulsion only to keep up its proper movement. Such was the result obtained by Huyghens, in substituting the pendulum for the primitive balance, and in attaching to the axis of suspension of the former, the pallets which the axis of the latter carried. The regulating pendulum, the oscillations of which are not strictly isochronous, but decrease in duration with the amptitude of the arc described, received from the mechanism known as escapement, the slight impetus required to compensate the loss of speed, and its movement remained therefore the same as long as the motor imparted this additional force. It was in 1656 that Huyghens conceived the idea of this important improvement, the following year he presented his first "pendulum-clock" to the government of Holland, and in 1658 he published its description in a special work. His genius was, however, not yet satisfied. The oscillations of an ordinary pendulum remain strictly isochronous only, so long as the arc described is very small, and the escapement then known did not admit minute oscillations. The reaction of the clock-motor on the balance certainly helped to maintain the desired equality; but several disturbing causes could alter it, and in a clock on board ship it would be quite illusory. Huyghens, who recognized the vast importance of solving the problem of longitudes at sea, laid a high value on the construction of a pendulum, isochronous, independent of the vacillations of a ship. Pressed by these considerations he called geometry to his aid, and his learned researches made him acquainted with a curve, the *cycloid*, on which a weight oscillates in regular intervals, whatever the extent of the arc. The study of the properties of this curve, and the processes invented to construct a pendulum whose bob described a cycloid, offer an admirable whole, in which the logic of the geometrician, and the genius of the mechanician seem to dispute the palm.

"It is true, however, that these brilliant labours did not admit its immediate application; what generally happens with productions, the joint work of the theorist and the workman, resulted here, the the latter did not always succeed in realizing the conceptions of the former in a satisfactory manner. Many difficulties were met in the execution of the "cycloidal pendulum," and also of the "rotatory pendulum" which Huyghens invented for the same purpose as the former. The introduction of a *spiral balance* in marine time-keepers, and of a new escapement which permitted small oscillations, soon did away with the cycloid.

"The improvements hitherto introduced by Huyghens were evidently only applicable to non-portable time-pieces; but it was not likely that his inventive genius should renounce procuring the same exactitude for watches. On the contrary, he never lost sight of this object, and, encouraged by his former successes, pursued it with ardent zeal. In 1674 he proposed to apply a *spiral spring* to the balance. To impart to the balance, isolated from the wheelwork, the same to-and-fro movement, Huyghens attached its axis to the interior extremity of a small steel blade in spiral form, fixed by its other end. Thus placed, the balance had only to be turned off at a certain angle, and the elasticity of the spring caused it to make isochronous oscillations around its original position. The elasticity of the spiral is here to the oscillating body what the weights are to the pendulum, and the escapement gave scope to the action of the watch-moter at each of the vibrations of the balance.

"The invention of the spiral spring has been denied to Huyghens by *Dr. Hook*, and by a Frenchman, the *Abbé de Hautefeuille*; and the pretensions of these two rivals led to litigations before the courts of justice in England and France. When carefully comparing dates, it must certainly be admitted that Dr. Hook first suggested (in 1660) the idea to replace the weights which move the pendulum, by the action of a small *straight spring*, an applicati which would but imperfectly fulfil the required conditions. It an authenticated fact that the first watch with a spiral spring wa manufactured at Paris in 1674 by a watchmaker named *Thuret* an under the direction of Huyghens, so that horology owes to th illustrious geometrician the modifications by which the regulat was provided with power to isochronize its movements.

"Another improvement in watches closely followed the last effort of Huyghens, and although it added nothing to precision, it effecte increased convenience. The early weight clocks, and even some the water-clocks were provided with chimes; but it was only each hour or ordinary subdivision of an hour that these bells mad themselves heard, and it was never supposed that the announcemen of the hour might be obtained at any moment, which result wa arrived at by the *repeating mechanism*. This useful invention entirely English; *Barlow*, in 1676, applied it to clocks, and te years later the same watchmaker contested its application to watche with another artist named *Omare*. It appears, however, that the attained their object by two different constructions.

"At this period horology already offered similar products to ou time. The watch had a chain, a fuzee, a balance with spiral spring it repeated the hours at any moment; it differed mostly in it execution and finish. Handwork began to advance the art; th artist's talent was brought into play to perfect and variate th mechanism, so cleverly combined by the learned; and to acquire degree of precision which the first inventors scarcely conceived. I horology had no other object than to supply a division of time sufficiently exact for the use of ordinary life, it might, without in convenience, have remained at the perfection it had now gained but, as we have already said, a higher sphere was reserved for it Astronomy and geography could not progress without it, and t their stimulating influence we must mainly ascribe the rapid stride which the art made in the eighteenth and the commencement of th present century."—*Journal Suisse d'Horlogerie.*

(*To be continued.*)

MYSTERIOUS CLOCKS.

M. CADOT, of Paris, has recently invented a curious clock. I has two apparently free hands placed in the centre of double pome, the two sheets of glass composing which are held i an ornamental frame. The clock is operated by concealed mechanis in the frame, which once a minute causes a slight and nearl invisible motion of one of the glasses. This causes the movement o the minute hand, and a minute train of gearing concealed in th pivot of the latter actuates the hour hand.

Mr. Robert Heller, the conjuror, has lately been exhibiting clock of his own invention, the mystery of which no one, we believe has yet fathomed. It is a clear disc of glass, marked with the usua numbers. The hands have no bulb or other enlargement at th centre, where it might be imagined mechanism could be concealed and appear to be simply pivoted to the face A ring like that of watch suffices for the support of the clock from two cords suspende from the ceiling. At the command of its owner, the clock mark any hour, moves backward or forward, and otherwise behaves in a astonishing manner. The use of the cord naturally suggests concealed wires and electricity, which is probably the secret of th movement. But this theory is somewhat damaged when the magicia removes the clock from its cords, and, holding it with two finger at arms' length, carries it in the midst of his audience and causes i to continue its performances under the very eyes of the people allowing the closest inspection. One clock like that would serve a an invaluable aid to an exhibiting spiritualistic medium, and woul cause wide-spread rejoicings among the elect.—*Scientific American.*

Prices Current for Gold and Silver—Value Given for Old Gold and Silver by Assay. Fine Gold, 84s. per oz. Fine Silver, 4s. 8d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3 d. per oz. Fine Silver, 5s. 3d. per oz. Standard Silver, 4s. 8d. to 4s. 10d. (variable.)

PRACTICAL INFORMATION FOR THE TRADE.

The colour of so-called oxydized silver does not depend on oxydation, but on sulphurization. The silver goods are dipped into a boiling hot solution of calcium sulphide, or hyposulphite of soda, or into amminium sulphide, until they have taken the proper colour. "Old silver" is a colouration produced by laying in a mixture of black lead and oil of turpentine, or some fatty matter, and cleaning off with blotting-paper until no more colour comes away. Copper acquires a handsome look if treated in the same manner. If it is desired to varnish oxydized silver, take 18 parts alcohol, 3 red arsenic, and 1 castor oil, and a non-transparent varnish can be made, which may be diluted with its own volume of alcohol if a particularly thin coating is wished.—*Engineering and Mining Journal.*

The *American Journal of Industry* gives the following new substitute for gold, said to be introduced by the French:—"100 parts by weight of pure copper, 14 zinc or tin, 6 magnesia, 3·6 sal ammoniac, 1·8 burnt limestone, and 9 cream of tartar. The copper is first melted, then the magnesia, sal ammoniac, limestone and cream tartar in powder are gradually added separately. The whole is kept stirred for half an hour, the zinc or tin being dropped in piece by piece, the stirring being kept up till they melt. Last of all the crucible is covered, and the mass kept in fusion for 35 minutes. The scum being removed, the metal is poured into moulds. The alloy is fine grained, malleable, and takes a high polish.

Artificial Coral can be made of 4 parts yellow resin, and 1 part vermilion, melted very fine.

To Polish Watch Wheels Without Injuring Them.—Take a flat burnishing file, warm it over a spirit lamp, and coat it lightly with beeswax. When cold, wipe off as much of the beeswax as can be readily removed; and with your file thus prepared polish the wheel, which should rest on a piece of cork. The finish will be of the finest kind, there will be no clogging, and the edges of the teeth, &c., will remain perfectly square.

Bell Metal.—An improved alloy for bell metal is proposed, which, it is said, does not tarnish, is less likely to crack, gives a better sound, and is much lighter in weight than the alloy usually employed for the purpose. It is prepared as follows:—Nickel, 1lb., and copper, 6 lb., are melted and cooled. Add zinc, 1 lb.; aluminium ½ oz. Melt and cool. Melt again, and finally add ½ oz. quicksilver and 6 lb. melted copper.

Another New Metal.—This metal has been named Lavoisium by its discoverer, M. Prat, in honour of Lavoisier. In shape it resembles silver; it is fusible and malleable. Its crystals are colourless, and its distinctive characteristics, according to M. Prat, are its silver colour, the nature of its spectrum, the solubility of its oxyde in ammonia, and the peculiar odour of its combinations with the ferrocyanide of potassium and with sulphuretted hydrogen. With the spectroscope the metal gives 23 lines, several of which coincide with those of copper, whence M. Prat conjectures that copper may contain the new metal.—*Medical Examiner.*

The following mode of procedure for taking rust out of steel is recommended by the *Scientific American*:—Place the article in a bowl containing kerosene oil, or rap the steel up in a soft cloth well saturated with kerosene; let it remain twenty-four hours, or longer; then scour the rusty spots with brickdust. If badly rusted, use salt wet with hot vinegar; after scouring, rinse every particle of brickdust or salt off with boiling hot water; dry thoroughly; then polish off with a clean flannel cloth and a little sweet oil.

Polishing Amber and Jet Articles.—To clean jet, use the softest brush that can be procured to remove the dust in the most gentle manner from the carving, and then touch the jet with a little good oil on a bit of cotton wool, and polish with wash leather. The process requires the greatest care, as the carving makes the material very brittle. To work amber for ornaments, trinkets, cane knobs, small boxes, pipe-mouthpieces, and other ornamental small wares, amber in the rough is first split and cut rudely into the shape required, by a leaden wheel worked with emery powder, or by a bow saw having a wire for the blade, tripoli or emery powder being used with it. The roughly-formed pieces are then smoothed with a piece of Swedish whetstone and water. The polishing is conducted by friction, with whitening and water, and finally with a little olive oil laid on, and well rubbed with a piece of flannel until the polish is complete. In the latter process the amber becomes hot and highly electrical; as soon as this happens it must be laid aside to recover itself before the polishing is continued, otherwise the article will be apt to fly into pieces.

CORRESPONDENCE.

It must be distinctly understood that we do not necessarily identify ourselves with the opinions or views of any of our Correspondents. Our pages are alike open to all for free discussion of questions connected with the various trades which we represent, and all Correspondents will find every opportunity afforded them for expressing their opinions.

QUACKS OF THE TRADE.

To the Editor of The Watchmaker, Jeweller, and Silversmith

Sir,—My object in writing this letter is, firstly, to draw attention to what is a source of disrepute to the trade, and, secondly, to ascertain, if possible, what can be done to remedy it. I allude to the great amount of damage done to customers' goods by inexperienced and incapable workmen, who, while holding out to the public the bait of "working for the trade" and "on the premises," deteriorate and ruin a large per-centage of the goods brought them by people who imagine they will save a profit on the job by going direct to the working man.

Let us first consider how it is that there are in the trade, in every town, such a number of men, professedly brought up to the working jewellery, who are unable to execute a careful gold or silver soldering, and whose only process seems to consist in soft solder and rosin. The root of the evil seems to me to lie in the system of apprenticing. A man opens a jobbing business, with perhaps a small quantity of goods in his window, and advertises for apprentices. Of these he takes as many as he can find board-room for. (I know one man who has thus taken six, with premiums.) Now no man can properly overlook three apprentices, much less six, and so the consequence is that a great deal of botching goes on whenever an apprentice meets with an accident. As for acquiring more than a very hazy idea of hard soldering, colouring, bleaching, &c., this is impossible. Of course, when out of his time, the apprentice must do something, he cannot be retained, as his place at the board is wanted for another apprentice and premium, and so, failing to obtain employment at any respectable place, by reason of his utter incapacity, he determines to set up for himself. Having fixed on his place of business, he has his name painted over the door in large letters, together with a catalogue of his acquirements, which, if it is to be believed, points him out as an admirable Crichton of the trade. He can "clean and repair all kinds of English and foreign clocks, watches, musical boxes, &c.;" he "repairs, colours, bleaches, gilds, plates, bronzes, burnishes;" in fact, he does everything on the premises (said premises being often 12 ft. by 12 ft.), and, worst prevarication of all, "for the trade." Soon people begin to notice the busy little man, whose small establishment is filled with such proofs of industry. By slow degrees he rises in the world, meanwhile learning a little more of the trade at the expense of customers' jobs, and as soon as he can afford to enlarge his premises, or to move into more commodious ones, he, in his turn, advertises for an apprentice or so. And thus the game is kept up.

I am not saying that the foregoing sketch is a sample of the way in which all or most of our general jobbers are educated. There are many apprentices who have the luck to be placed under an experienced man, and to have his exclusive attention, or nearly so. To these men the foregoing remarks do not apply. But I do not hold it to be fair or right that a man (inexperienced or the reverse) should have the power to take, say, more than two apprentices, and even then he would have more than enough to do to see to them and mind his own work; especially if, as is often the case, he attends to a shop at the same time.

I have before me now a fine gold brooch, totally ruined with lead solder, which, if properly repaired with gold and recoloured, would have been as strong (and stronger) than new; also a silver Geneva, nearly new, with the balance repaired at the crossings with lead. This last job belongs to a servant, who took it to one of these butcheries, where it was treated in the manner described. The charge for a new balance, &c., will fall rather heavily on her slender means.

Lastly, what can be done to place some check on this indiscriminate premium taking? I am afraid not much, if anything; the remedy lies in the hands of the public, of whom there are always too many ready to go to any man who writes himself up "Jeweller to the Trade." *Experientia docet*, but sometimes too late.

I am, Sir,
Your obedient servant,
Charles Desprez, Jun.

June, 1877.

HOW TO TEST WATCH OILS.

An oil fit to be used as a lubricator for fine mechanism should possess the following essential qualities:—It should neither thicken nor dry up, nor get hard at a low temperature, nor should it be subject to oxydation. In spite of the vast progress which natural science has made of late years, it has not succeeded in discovering an animal or vegetable oil possessing these combined properties without previous artificial manipulation. Let us mention a few instances:—

Almond oil has the valuable property not to become firm till below 17° R., but it oxydates sooner than any other oil. Poppy-seed oil will withstand cold to 15° R., and preserves itself well from oxydation; but it is one of the "drying oils," and therefore useless as a watch oil. The olive oil, up to the present the most useful among watch oils, does not dry or thicken, nor does it oxydate for a comparatively long time, but it hardens already at 2° R. The properties of neat's-foot oil are similar to those of the olive oil, but it exceeds the latter in resistance against oxydation.

These few observations will sufficiently show why technical chemistry always considered the production of an oil, fulfilling in every respect the requirements of fine mechanics, as one of the most difficult tasks. Most of the oils supplied to the trade answer its purpose but imperfectly. It is, therefore, not to be wondered at when conscientious men act with caution in introducing any novelty in that department; the more so, because the hitherto employed methods for testing oils required considerable time, and were often attended with loss.

We think it will be useful to our readers, if we point out the means by which such tests can be made with the least trouble and cost, and in the shortest time. We will first divide the oils into two classes:—

Drying Oils.—The best known among them are:—Linseed, hemp-seed, poppy-seed, and castor-oil.

Non-drying Oils.—To which belong the olive and colza oils, and those from the larger kernels, as almonds, hazel, and beech nuts, &c.

That drying oils are useless and objectionable for fine mechanism is evident, because they dry on exposure to the air by absorbing oxygen and generate carbonic acid. The quicker or slower drying depends simply upon the thickness with which the oil has been applied. A higher temperature will considerably accelerate the effects of oxygen, an advantage of which painters and cabinet-makers—the principal consumers of this kind of oils—avail themselves when despatch in their work is required. Oils, as regards this point, are, therefore, very easily proved. The article to be examined is laid as thin as possible on a piece of glass or china, and the latter is then put on a stove, care being taken not to expose it to too high a temperature, to prevent the oil from boiling, which would take place at 240° R. A degree of heat which boils water—*i.e.*, 80° R.—is quite sufficient to dry a thin layer of such an oil into a glassy substance in a few days. This simple process supersedes all others.

There are oils which do not belong to this class, but gradually thicken because they contain considerable quantities of mucilage, pectic acid, &c. Such is the ease with oils from the larger kernels, as almonds, beech, and hazel nuts. An exposure of these oils to a higher temperature will, in a few hours, manifest this defect also.

The next evil lies in the little resistance which oils offer to lower degrees of temperature. Every fat is, again, a conglomeration of other solid and liquid substances. The former are called stearine, margarin, palmitin; and the latter, olein, elain. According to the proportions of solid and liquid substances, the fat requires a higher or lower temperature to become liquid or solid. Tallow, for instance, melts only at 32° R., while linseed-oil remains still liquid at 22° R. An oil which can resist 10° R., will do very well for general purposes. The temperature in a room, even without a fire, will, by 25° R. in the open air, not sink below 8° to 10° R., and, besides, in the watch-pocket, next to our body, the watch is safely guarded from extreme cold. The watch manufacturer has not to consider extraordinary cases, and if inhabitants of the frigid zone and Arctic navigators expose their chronometers to extreme degrees of cold in the open air, he is not answerable for their rash treatment of his work.

If oils have to be tried as to their capability of withstanding a low temperature in summer time, the necessary degrees of cold may be produced as follows:—15 parts of Glauber's salt (the small crystalized sort) are put in a vessel of glass or china, and the flask of oil to be tested is immersed in it. This done, a mixture of 5 parts of muriatic acid, and 5 parts of cold water is poured over the salt. By means of a thermometer, such as is used for liquids, the temperature can be controlled, and when it shows 8° to 10° R., the flask may be taken out and the oil examined. If it has remained perfectly liquid, it has satisfactorily undergone the required test. Chemists can without difficulty separate the firm ingredients from oil, and produce an article which will stand 25° R., but this cannot be done without injuring it in other respects.

We come now to the most serious of all defects in watch oils, viz., oxydation, and therefore give our special attention thereto. Fats in general (liquid as well as solid) belong to the saline bodies, although they have in appearance nothing in common with salt. Salt is the name chemists give to a combination of an acid with a base, and under these bases they understand the oxydes of iron, copper, &c., the alkali, the alkaline earths, as lime, baryta, &c. So is the well-known Glaubers salt a combination of sulphuric acid with sodium for its base. The same base with carbonic makes our soda; and kitchen salt consists of chlorin with sodium for its base, or more exactly with the elementary substance of sodium, the natrium. If, in this combination, the acid is predominant, it is called *acetic salt;* if the base, *basic salt;* and if they are both alike, *neutral salt.* Such a neutral salt are all our natural healthy fats. The acids they contain are called *pyroleic acids* (stearic acid, elain acid, &c.), and the base, not yet known in its elementary state, is termed *lipyloxyd*, which, by further development, produces the better-known glycerine. Although these pyroleic acids are naturally neutral, and when bound to their bases cannot act as acids, yet they have an inclination to absorb oxygen from the surrounding atmosphere, especially at higher degrees of heat. This is what, in chemistry, is called oxydation. If this process continues, the acid in the oil becomes predominant, and acts then on metals precisely in the same way as any other acid, only does its damage slower and less apparent to the eye. The result is evident. Fine works, lubricated with such an oil, lose in volume, and the injury, which is often attributed to friction, is in reality the effects of this change in the oil. But this condition of the oil does not manifest itself till it has attained a highly injurious degree, and the work of destruction has already began. The organs of taste and smell are therefore insufficient to ascertain what degree of inclination an oil has to become rancid, or even to indicate at once when it has actually become so. The following method will answer this purpose: Pour the oil in a bottle, together with an equal quantity of water, in which soda (carbonic natrium) has been dissolved; then shake it violently and let the mixture stand for some hours. If the two liquids separate perfectly, particularly under a higher temperature, it is a proof that the oil is free from acid. On the contrary, if a whity substance shows itself between the two, it is certain that acid is present.

Another method is based on the great sensibility of litmus paper in regard to acids. Litmus paper can be bought at the chemist's but may be easily prepared as follows: Bring powdered litmus in contact with pure water (distilled the best) until the latter has absorbed enough colouring matter to dye dark blue immersed slips of paper. These slips are then thoroughly dried, and any acid applied to them will change their colour to a violet, or even red, according to the strength of it. Acids which have become free in an oil will have the same effect. It must be remarked that litmus blue, held to the light, is of a reddish tint in itself; and that litmus tincture, well shaken, will present rays of glaring red in the sunlight, and as the papers immersed in the oil become transparent, they will show a slight reddish hue even in the purest oil. But a little practice and comparison will soon enable to distinguish the effects of an acid on litmus blue.

In conclusion, we intend to correct a few traditional errors. Many think that the clearer an oil the better it is. This is a decided mistake. A bad colour certainly indicates impurities, but if colourless or yellow, is in this respect immaterial. In fact, those very clear oils are generally the most apt to become rancid, because the methods employed for the clearing process tend mostly to forward oxydation.

To test the fluidity of oils, by letting different sorts run off an inclined plane, is also a doubtful experiment. Not only are there oils so poor in body, that they flow too freely, and do not give the required protection against friction, like the sesame oil, but many other obstacles—scarcely observable with the bare eye—such as a slight unevenness in the surface of the plane, may influence this trial. A far more reliable way of ascertaining the desired degree of fluidity, is to saturate a strip of blotting-paper with the oil, and watch whether the drops will fall off in pearls, or show an inclination to spread out. The latter is a certain sign of a viscid oil.—*Allgemeines Journal der Uhrmacherkunst.*

HISTORY OF ASTRONOMY.

(Continued from page 203).

BY means of the telescope Gassendi, a French astronomer, first observed, in 1631, the transit of Mercury across the sun's disc, and in 1639, that of Venus was seen by Horrox, an Englishman. These phenomena were then considered merely as remarkable and interesting spectacles, but they have since been made conducive to the determining of the sun's distance from the earth, and the solution of other astronomical problems.

About the same time, Riccioli, a Jesuit, published a work, which he denominated the new "Almages," in which he was much assisted by Grimaldia, the author of a treatise called "Telenography," in which the different parts of the moon are distinguished by names, the greater number of which are still retained by astronomers.

Many improvements were made in the telescope by Huygens, Sontana, Cassini, Morin, Azoul, and Hook, by which more accurate observations could be made on the heavenly bodies.

Morin discovered the method of ascertaining the longitude by astronomical observations. Huygens discovered the fourth satellite of Saturn, and Cassini the first, second, third, and fifth. In 1666, Azoul applied a micrometer to the telescope for the purpose of measuring the diameter of a planet, and other small distances in the heavens. About this period, several public institutions were formed for the propagation and improvement of science; and a different species of telescope, called the reflector, was invented by Gregory, who contented himself with pointing out how it might be constructed, and left the actual construction of one to the illustrious Sir Isaac Newton, than whom no one stands higher in the catalogue of benefactors to the cause of learning.

Sir Isaac Newton not only completed a reflecting telescope, from the hints given by Gregory, but greatly improved upon them, as did David Gregory and Euler; but as the imperfection of the refracting telescope was in great measure removed by Dolland, about the beginning of the eighteenth century, reflectors are now seldom used.

L'Abbe Picard was another eminent astronomer of modern times, and by discovering an accurate method of measuring a degree of a great circle of the earth, rendered it easy to ascertain with considerable precision, the whole circumference of it. The discovery likewise by Richter that the pendulum performed its oscillations slower at the equator than near the pole, suggested to Sir Isaac Newton the idea, which has since been confirmed, that the equatorial diameter is longer than the Polar; and consequently that the globe is an oblate spheroid, or flattened at the poles.

In the beginning of this century, Graham, a celebrated mechanic, made many valuable and accurate instruments for the Royal Observatory, at Greenwich, particularly a zenith victor of 24 feet radius, and another of 12½ feet, with which Dr. Bradley discovered the aberration of the fixed stars. Hadley's improved reflecting telescope, and the quadrant and sextant which bear his name, have given him a place amongst the eminent cultivators of his science.

So zealously have modern astronomers directed their attention to the improvement of telescopes, that their powers have been increased to an amazing degree. By means of reflectors of his own construction, the late Sir W. Herschel made many valuable discoveries, and it is yet impossible to say how far these improvements may be carried. Our posterity will probably become acquainted with the nature of the moon's surface, and discern her cities and towns, and even her inhabitants, if such really exist. In the beginning of the eighteenth century, Roemer, having observed that the eclipses of Jupiter's satellites happened sometimes sooner and sometimes later than the time calculated, and set down in Cassini's tables, inferred that this difference arose from the greater or less distance of Jupiter from the earth; from this circumstance he was enabled to ascertain that light has a progressive motion of nearly 200,000 miles in a second of time. Numerous observations have confirmed the truth of this discovery.

Few names amongst celebrated astronomers stand higher than that of Flamstead, who was appointed astronomer royal by Charles II., and intrusted with the care of the Observatory at Greenwich. Among his other valuable labours, was a catalogue of 3000 stars, with their places. He died in 1719, and was succeeded by Dr. Halley. Cassini Astronomer Royal, of France, was well skilled in the science; he is celebrated as having drawn a Comet-Meridian line in the church of St. Petronius, at Bologna. The son, grandson, and great-grandson of this philosopher, inherited their ancestor's talents, and successively filled the honourable station to which he was first appointed.

Dr. Halley having been sent to St. Helena, to form a catalogue of the stars in the southern hemisphere, published the results of his labours in 1679. He made many interesting observations on the moon, and successfully predicted the appearance of a comet in 1758. The dispute between Newton and Cassini respecting the figure of the earth—the former representing it as an oblate spheroid, or flattened towards the Poles, and the latter a prolate spheroid, or protruded at the Poles—being undetermined, Louis XV. sent out two parties of astronomers to measure two degrees of a meridian, one near the equator, and the other within the Arctic circle; the result of the expedition fully confirmed the truth of Newton's theory, and set the dispute at rest for ever.

Besides the aberration of the fixed, called the procession of the equinoxes, already mentioned as having been discovered by Dr. Bradley, that eminent astrononer observed, that there was an annual change of their declension. After diligently investigating the cause of this phenomenon, he attributed it to a kind of libratory* motion of the earth's axis, occasioned by the inequalities of the action of the sun and moon according to their situations with respect to the earth and to each other. In 1769 the Rev. Dr. Nevil Maskelyne was appointed Astronomer Royal. About this great period large improvements were made in astronomy, and in its application to valuable purposes Clairault, Euler, and Meyer, composed complete sets of Lunar Tables, and as those of Meyer were considered the most accurate, he was presented by the Board of Longitude with 3000*l.* as the reward of his labours.

Wargenstein, a Swedish astronomer, made many valuable observations on the satellites of Jupiter, and De la Caille composed an excellent set of Polar Tables. He likewise took a voyage to the Cape of Good Hope to correct the catalogue of the stars in the southern hemisphere, to determine their situations with accuracy, and to discover the parallax of Mars, the moon, and of the sun. The period now approaching when Venus would traverse the sun's disc, astronomers were sent to different countries to observe this phenomenon, which took place in 1769. A similar event predicted by Dr. Halley eighty years before, had taken place in 1761, and had been diligently attended to. The result of these different observations was that the parallax of the sun is about eight and a half seconds, and, consequently, that his distance from the earth is 96,000,000 of miles. In 1761 Dr. Maskelyne was sent to St. Helena to observe the transit of Venus and the parallax of Sirius, and though, from some unforeseen accident, he did not succeed in the primary objects of his voyage, he enriched science with many interesting and useful facts collected by him from diligent observation. One service he rendered to navigation was the introducing among seamen the method of finding the longitude by the Lunar distances with Headley's quadrant. He also took a voyage to Barbadoes to settle the longitude of the place, and to try Harrison's timekeeper and Irwin's marine chain. On his appointment to the post of Astronomer Royal, in 1765, he proposed to the Board of Longitude the publishing an ephemeris, or nautical almanac, for facilitating the practice of the lunar method, it was accordingly published in 1767, and has been continued ever since, to the great benefit of navigation.

The name of Herschel is high in the annals of astronomy. He constructed more powerful telescopes than had been in use, and from his indefatigable and accurate observations, corrected many errors that had obtained for ages, and made discoveries that astonished mankind.

March 31, 1781, Dr. Herschel discovered that a star, which had been many years before observed by Flamstead, and considered by him as fixed, was, in reality, a planet revolving round the sun at the distance of 1,800,000,000 of miles. This great man died in 1822.

About the commencement of the nineteenth century four new planets were added to the list of those already known; Ceres, discovered by Piazzi, an Italian astronomer at Palermo, in Sicily; Pallas, by Dr. Olbers, at Hamburg, in 1802; Juno, by Mr. Harding, at Lilienthal, in 1804; and Vesta, by Dr. Olbers, in 1807; their respective magnitude and periods are not as yet very accurately known, their orbits all lie between those of Mars and Jupiter.

It would seem as though, from the great discoveries that have been made by astronomers since the invention of the telescope, that little remains to be known within the compass of man's abilities to obtain; but the heavens are a vast book, and men are indefatigable students who succeed in turning over new leaves when such a circumstance is expected.

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* Balancing, playing like a balance.

New Clock at Ealing Cemetery.—A new self-acting tolling apparatus and clock combined has just been erected at the Ealing Cemetery, by the well known turret-clock manufacturers, Messrs. Gillett & Bland, of West Croydon.

A DAY IN A COVENTRY WATCH MANUFACTORY.

Among the marvellous developments of mechanical ingenuity which the present century has witnessed, none will take a higher rank than that which has been successfully applied to the highly skilled art of the practical horologist. Every year heralds some further advance, and it is but the barest justice to our trans-atlantic cousins to say that their active brainwork has spurred us on. There is no denying the fact that we are conservative to a fault; clinging with great tenacity to our old methods—merely because they are old—long after their practical and commercial utility have passed away. Generation after generation resolutely sets its face against change long after the necessity for change has been amply demonstrated; in fact, the history of our manufacturing progress has been a history of opposition. We grumble, we threaten, and we "strike" at the first indication of what is coming. For want of an elementary belief in the irresistible onward march of economical production we force our trade into other hands and leave ourselves nothing but the proverbial stool of repentance. To be sure we have had our leaders; but they being of much the same mental compass as ourselves, have led us where the blind always lead the blind. To reason with us, or to attempt to reason with us, is something like preaching to a post; and, thus, on we go until the inevitable sweeps us out of its way. As a pendant to this introduction, it seems scarcely creditable that it is not yet half a century since our frequent and hostile combinations brought into the world the self-acting cotton-spinning mule, and perfected the power-loom. Coventry, too, has its own similar tale of ignorance and impotence to tell with respect to its ribbon trade. The late Mr. Beck, at the daily risk of his life, and the ultimate destruction of his property, saved the town from extinction in the ribbon manufacture by the successful invention of the many-shuttle loom. The city of the Three Tall Spires ought not to omit the perpetuation of the names of her local worthies.

Curiously enough, the fame of Coventry as a watchmaking—the great watchmaking—centre of England, is not eighty years old. It was about the year 1800 that the making of time-keeping machines began in that old city. It may not be generally known that its ancient staple trade was the manufacture of woollens, broad-cloths, and caps! Before 1580 there was a kind of world-renowned manufacture of blue thread, the peculiar qualities of the colour is said to have been produced by the chemical constituents of the water of the Sherbourn. In the eighteenth century a large trade was done in tammies, camlets, shalloons, gauzes, and similar articles, but we believe that it has long departed; ribbons came in about 1730, and silk braiding soon followed. The foregoing remarks all lead up to a point as to when the great trade of this ancient city took its rise, and how it came to flourish.

We have said that time-keeping machines began to be made in Coventry about 1800, and since then what a change! At that period the well-known "Board of Longitude" were much exercised about the chronometer of Thomas Earnshaw, for, in that very year, they voted him the sum of £500. Shortly afterwards they resolved—

"That the Board are convinced that Mr. Earnshaw's watches have gone better than any others that have been submitted to trial at the Royal Observatory, and therefore are of opinion that he deserves a reward equal at least to that given by Parliament to Mr. Mudge, provided he will disclose the construction of his timekeepers in such a manner as shall satisfy the Board that other watchmakers will be enabled to construct them with equal accuracy."

And Mr. Earnshaw obtained £2500 in addition to the £500 voted by the Board "to do justice to Mr. Earnshaw's merits."

The manufactory which is the subject of this paper, is that of Mr. Thomas Wallen, and is situated in King-street, Coventry. It consists of a newly-erected pile of buildings, specially constructed for the nature of modern work. Upon entering the ground-floor of the premises, the first thing that attracts the attention of the visitor is the steam-engine. Imagine for one moment a steam-engine in a watchmaker's shop in the days of the Board of Longitude! Reflections like these serve to link on the present to the past, and make us pause at the progress we have witnessed. After looking at the steam-engine, our next object of interest was a case-making machine. A case-making *machine!* Was ever such a thing heard of in the watch trade before? There are those in Coventry—and in London, also, we have been informed—who affect to doubt its existing, and who pooh, pooh its working altogether. They say that it is a myth, only existing in the imagination of somebody or another. But these fingers have felt and have handled its productions, and these eyes have seen it at work, and if it be a myth, it is a very solid one indeed. As far as one can fairly judge its operations from a neutral point of view, this machine has certainly inaugurated a complete revolution in the method and speed of watch-case making. It seems to have, in its power of production—working under royalties—a fortune within itself. Watchmakers cannot too earnestly accept the fact that, from what we saw, and what was stated to us on the cost part of the question, if they wish to hold their own in the keenly contested race with other nations, they cannot call in the aid of this case-making mechanism too soon. We will now state the results of its work, prefacing what we are about to say by the fact that any verbal attempt at description would be utterly useless without drawings; besides, the machine has a stamping-press detailed for its special service when in active operation.

Let us begin with a strip of flat metal—gold or silver as the case may be—and punch the blanks out at the rate of about twenty a minute. These blanks next go into the stamping-press, and sooner than we can tell it, up they come stamped into shape; the die having provided for joint-beds and thumb-pieces, by which provision all after-filing is got rid of. The next process is that of annealing, in order to bring the metal back to a proper softness after the tremendous squeeze that has been given to it. We saw the cover, the bezzle, and the "box" each and all in their turn perfectly shaped by one turn of the die-press. The steps and band of the "box" came out perfect in shape. We do not know that we would be acting with authority did we state how the railway bezzles are made, but they are turned out, like all the rest, with a rapidity that is simply astonishing. After the stamping, the pieces are removed to the new machine for finishing and flatting the edges, and now the art and mystery begins. The particular piece is fitted on the bed, an operation of about a second or so, the machine is set in motion, and in about five seconds more there is the work finished off, stepped, moulded, edged, knurled, and all ready for jointing, which is likewise done by machinery. How much more expeditious and different is this from the ordinary method of soldering a wire on occupying between thirty and forty minutes. We have said that it takes but five seconds for the machine to do its share of the work to each part; that is quite true, for we timed about half-a-dozen operations so that there can be no mistake about it. It was really difficult to believe the evidence of one's senses in relation to what was going on; but there was the machine whirling away, and turning out piece after piece in a continuous reality at the rate of one every five seconds. Of that there was no mistake whatever. No soldering, no chipping, no filing, but all ready to be put together and formed into a watch-case to receive the movement and be polished. Another thing, when the different parts of the case were snapped into one another after leaving the machine, they could only be separated by the action of a strong knife-edge, in other words, they seemed to be thoroughly water-tight. We were told, however, that before being sent off they were eased a little, so as to open and snap in without any unnecessary trouble whatever. By way of giving an idea of the great accuracy of this new power in the watch trade, the bezzle, after leaving the machine, fits down on the dial so closely that the obstruction of a fine hair would be an appreciable quantity.

It must be borne in mind that there is no cutting-tool used, and, consequently no metal taken off.

"Well, but how is it done?" it may be asked. We can only go so far as to say that it is done by pressure in motion, which, whilst it finishes the shape, closes the pores of the metal and makes a remarkably durable edging. A small amount of "bur" can be understood; but that is cleaned off by a dozen turns in a lathe that apparently does nothing else.

The reader will have no difficulty in comprehending the fact that all the parts of these cases are interchangeable. We made a sufficiently testing trial so that we are in a position to speak with certainty. Furthermore, an estimate was gone into about the powers of production, and from that estimate it was stated that a few of these machines in full work with their attendant die-presses could pretty nearly manufacture a sufficiency of watch-cases for all the watch-makers in England. All sizes can be made, and speed of work is only limited by the rate of feeding with blanks, whilst the artizan who works it never saw cases made in his life until he began to manipulate that extraordinary combination of mechanical contrivances.

After the "burr" is taken off, the pendant-hole is made, the pendant fitted in, the jointing finished, and the case completed. In the operations under notice, the pendant-hole is punched "clean through," instead of the usual method of drilling. This punching is adopted both with regard to economy of time and cost. In the first place it is done instantly, and in the second there is no waste. We may add, too, that the stud of the pendant being made to a gauge agreeing with the hole, the one fits into the other with a tightness that seems to render any soldering superfluous. The cutting for the winding and setting squares is a matter which can be understood without any detailed description, so may the polishing as well. With respect to the "hall-marking," we will venture upon a word or two. We saw a batch of cases that had just returned, and they certainly had the look of rough usage. A great deal of time has to be expended upon them to get them "straight" again. We were sorry to see this, and to hear what we did about it. Such is an epitome of the results of the machinery that, as we previously stated, will ere long make a noise in the watch-manufacturing world.

In passing on to the movement-making and finishing department, although we saw much that was very interesting, our admiration had been so monopolized by the case-making that little was left for the other workshops. There were machinery-shafting, pulleys, driving-straps, and all the etceteras of an engineering-looking business. It is quite clear that Coventry has still further awoke, and has taken another step in the onward path of mechanical progress. We must not omit to state that these shops are sealed against the inspection of ordinary visitors, because there are machine-tools, appliances, and processes connected with form, accuracy, cost of manufacture, &c., which might be detrimental to be known outside the walls. It is said that "there are secrets in all trades." In part confirmation of this we can certainly affirm from personal observation, that there are secrets in the trade of watch-making by steam machinery.

Let us take the frame of a watch. We begin by producing the plates, and getting them ready for drilling; then, what for want of a more precise name we will call a new "depthing-tool" comes into operation, and, at the expiration of a minute, or at the most of two minutes, every pivot-hole is in both plates, and they can be passed on to be prepared for the going parts. Compare this rapidity with the directions given by an old authority about the plates of the frame "when properly hammered, filed, and scraped, or planed," &c. If that old authority could now "revisit the glimpses of the moon," and stroll into the King-street works, he would see the whole watch and cases made, jewelled, sprung, cased, and set going, long before he had ended his hammering, filing, and scraping! *Nunquam dormio*—never asleep—is the motto of the successful modern watchmaker. In England he has neglected it too long; hence, instead of being in the front rank in the markets of the world *in manufacturing value*, as he has been in quality, he has to fight against competitors all round him. Having had the caliper "struck" upon the plates, such holes as are to be jewelled are named, and away they go to the jeweller in another shop. Here, again, we find his lathe steadily mounted and driven by steam, or more correctly speaking, by overhead pulley-shafting. All watchmakers know that jewelling is delicate, highly-skilled work, and that both hand and eye cannot be too steady in piercing and opening out the holes. Take, therefore, a firmly fixed lathe of the best construction, driven by steady shafting, how much superior must the work be, to that which is produced by any other method, and the slightest consideration of the subject will be sufficient to convince any one that it must be so.

We will now speak in a general way of the movement, although, from what has been said about the use of machinery, the reader will be prepared to hear that not only the wheel-work, but all the collateral parts are produced by the action of some machine-tool or another. For instance, we saw a wheel stamped out in the blank, cut, polished and pivotted in a very few minutes, and similar rapidity applied to pinions and stud-work. We must not forget to mention the screw-cutting. We saw an intelligent little girl working one of these machines, and turning out we are afraid to say how many an hour; whilst her elder sister, with a well practised eye and hand, was wheel and pinion cutting from time to time. Then there were the engine-turning, the fluting, and the polishing machinery. Thus on we went from one place to another until we reached that important bench where the springing and timing is done; and ultimately the last scene of all, the office, where we sat down and began to reflect upon what we had seen. Upon looking round we felt strongly inclined to parody the words of Tennyson:—Watches "in front of us," watches "in rear of us," &c., for there were watches everywhere.

Where do all the watches go to; what becomes of them? England, America, France, Switzerland, all running into the great ocean of watches! Has humanity turned watch-mad, or what is it? With respect to the King-street works and its watchmaking machinery, we verily think that, if we took a fancy for a particular throw of the case-making machine, and mentioned it, by the time we had concluded our inspection of the various shops, and reached the office, Mr. Wallen would present us with that identical case and its contents, with, "Here is your watch, sir," nearly every item of which had been made during our progress through the manufactory. We do not believe that we can point a moral with a more forcible illustration of the power of watchmaking by steam machinery.

Improvement in the method of manufacture is not allowed to go on alone, nor to be the all in all of practical advancement. The principles of construction have even undergone a change. For instance, we were shown a full-plate fuzee lever, having the following important points in its action:—The movement is re-arranged upon an entirely new plan, the result, we understand, of a series of experiments conducted by Mr. Wallen himself. This full plate has no bar on pillar-plate, nor potence, the balance-staff going direct into the plate, thus giving central action to the escapement. The 'scape-wheel, too, is so arranged that there is no possibility of a broken chain getting near it to do any damage; its position is clear away from the fuzee and barrel. It is made in all its parts by new machinery, the paramount advantages being *a soundness of construction and an economy of manufacture* that has been hitherto utterly unobtainable by any other means. We regret that we are not at liberty either to describe the mode of manufacture, or the consequent reduction in cost, Mr. Wallen keeping those items of information within his own workshops for the present. Several very good specimen orders have been already executed from the pattern calliper, and the universal satisfaction which it has given upon trial has been strongly expressed in letters that have been placed before us, such letters concluding with supplementary orders. In the making of the movement there is no filing, hammering, nor plugging; it can be held up and looked through perfectly clean, and free from all misfitting disfigurement whatever. Indeed, we expressed an opinion that, where sentiment was not in question, the three-quarter plate had now to face a powerful rival.

With respect to the extent of interchangeability, as carried out at the King-street factory, we can give an additional illustration:—Mr. Wallen has for some time been turning out a new "Independent centre-seconds Chronograph" on a calliper of his own. There has been a great "run" on these watches, and it still continues. We saw a regiment or two of them lying about, and the thought suddenly occurred to us of putting them "through their facings." We accordingly took up a dial, and sent it through the ordeal of at least a dozen plates. We must honestly say that the dial "clicked" down on every plate with the tightness of a snap-case. We next took a plate of a different size, and worked it through another dozen of different dials, with precisely the same result as before; that is, that we ran a dial through a dozen plates, and a dozen dials through one plate of a different size from the first, and, to our surprise, we did not meet with a single misfit either way!

There can be no question, when we come to reflect upon these matters, that the organizing and concentrating all the multiform operations under one directing head, are the prime causes of success in modern manufactures. We have met with an old proverb somewhere, that carries a good deal of practical truth with it, namely, that "The master's eye does more work than both his hands." In these workshops, whether for watches or otherwise, everything is under the master's eye, even from the man who feeds the boiler fire, to the packer who packs the goods and sends them away. The master, too, is accessible from all parts of the building any moment, and all parts are accessible to him. The result of this is constant supervision, both of workers, work, materials, and machinery. How different to the small "chamber-master," the man and a boy style, working only at some particular article. In hand-made watches nearly every different part goes to a different man, with the consequence that all the parts are frequently distributed over a parish. If they do not happen to fit when they come home, then there is plugging and filing, and—botching. In the organized workshop, where the watch is made complete by machinery, such a condition of things would be simply impossible. There is the master and his foreman at every turn, and if anything goes wrong either by negligence or accident it is detected and rectified *instantly*. Such being the case, the work must necessarily partake of the highly methodical nature of its manufacture, and exhibit a superiority of quality that is quite unattainable in any other way. After what we have recently witnessed we have not the slightest hesitation in saying that the days of watchmaking by hand are numbered. Machinery is doing it all; slowly it may but not the less surely. With the change, watch-buyers will increase and multiply, and, in conclusion, we pray, "the sooner the better."

Keyless Clocks.—The Seth Thomas Clock Company (of which Mr. R. M. Marples, of 16, Worship-street, Finsbury, is the agent), has just introduced a novelty in the shape of a pretty little clock, which is wound without a key. The winding apparatus is attached to a small lever at the back of the clock, by which means the hands, &c., are likewise set. Up to the present, the Company has not been able to keep up with the numerous orders, although they are turning out nearly 4000 of them per week.

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from* p. 291.)

THE chain used in connecting the mainspring and fusee in watches and clocks is composed of small pieces of sheet-steel, and it is of great importance that each of these pieces should be of exactly the same size. The links are of two sorts: one of them consisting of a simple oblong piece of steel with two holes in it, and the other formed by connecting two of the same pieces of steel placed parallel to each other, and at a small distance apart, by two rivets. The two kinds of links occur alternately in the chain; each end of the single pieces being placed between the ends of two others, and connected with them by a rivet passing through all three. If the rivet-holes in the pieces for the double links are not precisely at equal distances, the chain will not be straight, and will consequently be unfit for its purpose.

The hair-spring of a watch is no less remarkable for the extreme delicacy of its construction than for the proof which it gives of the great value that can be given to a small piece of steel by manual labour. Four thousand hair-springs scarcely weigh more than a single ounce, but cost often more than £1000. "The chisel of the sculptor," says Mr. Thompson, "may add immense value to a block of marble, and the cameo may become of great price for the labour bestowed, but art offers no example wherein the cost of the material is so enhanced by human skill as in the balance-spring." The pendulum spring of a watch, which governs the vibrations of the balance, costs at the retail price twopence, and weighs fifteen one hundredths of a grain, while the retail price of a pound of the best iron, the raw material out of which fifty thousand such springs are made, is the same sum of twopence.

A watch it is said ticks seventeen thousand one hundred and sixty times an hour, that is four hundred and eleven thousand eight hundred and forty times in a day, and one hundred and fifty millions four hundred and twenty-four thousand five hundred and ten times in a year, allowing the year to be three hundred and sixty-five days and six hours long. If a watch went, as some will, for one hundred years, it would beat fifteen thousand and forty two millions four hundred and fifty-six thousand times.

Watch glasses were formerly made in England by workmen who purchased from the glass-house globes of five or six inches in diameter, out of which, by means of a piece of red hot tobacco-pipe, guided round a pattern watch glass placed on the globe, they cracked five others; these were afterwards ground and smoothed on the edges. In the Tyrol the rough watch glasses are supplied at once from the glass-house, the workman applying a thick ring of cold glass to each globe as soon as it is blown causes a piece of the size of a watch glass to be cracked out. The remaining portion of the globe is immediately broken and returned to the melting pot. Formerly this process could not be adopted in England with the same economy, because the whole of the glass taken out of the pot was subject to excise duty. In England, at the present time, the crown glass, used for enclosing the dials of clocks and watches, before being moulded or bent into the required form, is first cut into circular shape by means of a circle-cutter, which consists of a circular board, covered with wash-leather, which is made to revolve on a pivot by one hand of the operator, while with the other hand he presses down a diamond on to the glass; the diamond is fixed at the end of an adjustable arm, which traverses a slot, the exact diameter of the circular plate to be cut, being regulated by an index fixed at the side of the slot.

The circular flat plates, which are removed to moulds turned out of solid firestone, the sinking of the moulds being of flat elliptical section, are put into one or other of the furnaces, according to the size of the glass to be bent. While in the furnace, the mould is kept in continual circular motion by the long iron rod of the operator, until the glass sinks into the required form. The grinding and polishing of the edge of the glass is the next operation. By a simple and ingenious contrivance, the edges of clock and watch glasses are ground. The operator stands in front of the work, with his right hand turning round a handle, placed vertically above the bench, and with his left hand holding a sort of hood, or cup, supplied with emery powder, by which the grinding is partially effected; the glass to be ground is temporarily fixed on a boxwood mallet, by means of cement, at the top of a spindle, which passes through the bench, and to which rapid motion is communicated by a round band from a horizontal wheel below the bench turned by the right hand of the operator. After the grinding is completed, the edge of the glass is smoothed with pumice-stone and finally polished with oxide of tin, usually called putty-powder.

"To become a good watchmaker," says Berthond, "it is necessary to be an arithmetician, in order to find accurately the revolutions of each wheel; a geometrician to determine correctly the curve of the teeth; a mechanician to find precisely the forces that must be applied; and an artist, to be able to put into perfect execution the principles and rules which these sciences prescribe.

"He must know how fluids resist bodies in motion, and be well acquainted with the effect of heat and cold in different metals; in addition to these acquirements he must be endowed by nature with a happy genius to be able to apply them all in the construction of an accurate measure of time."

As to Swiss watches. It has been stated that the beginning of the Geneva watch-trade was owing to the bloody persecution of the Protestants in France towards the close of the sixteenth century, which caused some French watchmakers to take refuge in Switzerland. In 1587, Charles Cusin, of Autun, in Burgundy, settled in Geneva as a manufacturer of watches, which were then sold for their weight in gold. He had many scholars, and his success naturally drew labour from less profitable employment, and spread the watchmaking trade very rapidly. But the substantial introduction of watch-manufacture into Switzerland, which, by the extensive employment of female labour, competes successfully with England, occurred in this manner:—"In 1679, a native of Switzerland, after a visit to this country, took home with him from London a watch, which was a novelty in his mountain land, and greatly excited the curiosity and interest of all who saw it there. On its getting out of order, the owner of the watch trusted it for repair to a mechanic, named Daniel John Richard, of La Sange, who, after attentively examining the mechanism of it, determined to construct a watch after its model. He accordingly spent a year in making the requisite tools, and in six months afterwards completed a watch. He next set up in the trade of a watchmaker, and supplied his neighbourhood with watches. He died in 1741, leaving five sons, who pursued their father's profitable business. The trade has been largely developed during the present century, and Swiss watches are in considerable demand on account of their cheapness. Sir John Bennett, whose advocacy of female labour in the watchmaking art has rendered him very obnoxious to some persons, calculated a few years ago that no less than 200,000 Swiss watches were annually imported or smuggled into England, while the whole produce of the English watchmakers did not exceed 186,000. In the valleys and in the slopes of the Jura mountains, during a winter which lasts six or seven months, the inhabitants, who are kept indoors by the inclemency of the weather, vigorously pursue some one or other of the several departments of the watch-trade. Sir John states that in a visit paid by him to Neuchâtel, where the largest number of the Swiss watches are made, he found no less than 20,000 women employed in making the more delicate parts of the watch movement, and earning upon an average fifteen shillings per week each. They produced annually about 1,500,000 watches, besides movements, for the American markets.

An old astronomical watch, of Swiss manufacture, was exhibited by Mr. Morgan to the Society of Antiquaries in 1850. It was made at Geneva by Jean Baptist Duboule, and bore a striking contrast to the Geneva watches now in use. It was of large dimensions, being three inches and a half in diameter and two inches thick, and was, in fact, a clock-watch; it had an alarum, and showed in the different circles of its face the hours and the period of the day, whether morning, noon, evening, or night, by certain allegorical figures engraved in a revolving disc, which changed suddenly and presented themselves at proper times. The days of the week were also represented by revolving figures, the days of the month, the name of the month, and the number of days it contained, together with the sign of the zodiac in which the sun was, the age of the moon and its phases, and the four seasons of the year "as they in their circle run," by allegorical figures engraved on a revolving disc in the same manner as the four periods of the day. This complicated and beautiful piece of mechanism was not quite in its original state; some former possessor about a century and a half ago caused a new balance-wheel with pendulum spring to be added, to make it perform more regularly. It was enclosed in a travelling-case of black leather, ornamented with silver studs.

The number of watches imported from Switzerland into this country in 1858 was 346,894. The returns of Goldsmiths' Hall afford the following statistics of English manufacture in the number of watch-cases hall-marked, in 1858, in London, 83,614 silver, and 26,870 gold; in Coventry, 60,000 silver. By our Transatlantic cousins British watches were preferred; thus, in 1857, we exported to America 14,141 watches of home manufacture, and 400 of foreign make. On the contrary, Australia showed a preference for foreign watches, by taking 6722 of them, and only 3082 of British manufacture. During the year 1860, 100,000 foreign watches passed through the Custom House for home use. The number of foreign watches imported into England free of duty during the first seven months of the year 1865 was 86,114, and during the first eight months 96,401, as against 87,282 in 1864, and 100,938 in 1863, periods corresponding with the latter months.

The Parliamentary inquiries which have been instituted from time to time into various matters connected with the clock and watch trade have served to enlighten us as to its extent and the regulations by which it was controlled. All the clockmakers and other persons using their trade within London and ten miles therefrom were incorporated into one body, with powers to make bye-laws for the government of those persons who used the trade throughout England, and to control the importation of foreign clocks and watches into this country, and to mark such as were imported. By the custom of marking foreign watches with the stamp of the Clockmakers' Company, of marking each English watch with the maker's name, and of the stamping of the cases at Goldsmiths' Hall, the number of watches produced in England became tolerably well ascertained.

In a report of a Committee of the House of Commons in 1818 it is stated that the number of gold and silver watch-cases marked at Goldsmiths' Hall in the year 1796 amounted to 191,678; and in the year 1798, when duties were imposed upon clocks and watches, and a license to deal therein was made necessary, the number of watch-cases hall-marked was reduced to 128,798, showing a decrease of 62,880. Although these duties were repeated, the manufacture never recovered itself. In 1808 the number of watch-cases marked was most approximate, it being 180,389. From this year the number diminished, so that in 1815 only 134,269 watches were hall-marked, and in 1816 only 102,112, rather more than one half of the number marked in 1796. Babbage, in his "Economy of Manufacture," says that the number of watches manufactured for home consumption was, in 1798, about 50,000. If this supply was for Great Britain only, it was consumed by about ten and a half millions of persons.

Two causes are clearly assignable for the signal declension in the manufacture of watches, as already mentioned, the imposition of a duty on clocks and watches in 1797, and the elicit importation of foreign watches. During the Pitt administration, an Act was passed levying certain duties upon clocks and watches, to be paid by the possessors of them. It was ordered by this Act that, after July 5th, 1797, an annual duty of five shillings should be charged on every clock or timekeeper; for every gold watch kept, worn, or used, ten shillings; and for every silver or metal watch, two shillings and sixpence per annum.

(*To be continued.*)

Valuable Diamond Necklace.—There is a wonderful diamond necklace to be seen at Messrs. Hancocks, of Bruton-street. Years have been spent in the collection of the stones, and now £27,000 will have to be spent by any one who may wish to profit by the labour of those years. £27,000 is, as "Mr. Jawleyford" would say, "a vast of money;" but diamonds are always worth the money paid for them, wherein they differ greatly from "fashionable" pictures—witness Mr. Albert Grant's recent sale—and old china. There are twenty-five stones in all in this necklace; the centre, and of course the largest, about twenty-four carats in weight, and the others, "fine by degrees and beautifully less," tapering off to about five or six carats. The Queen has seen it at Windsor, and so, too, have their Royal Highnesses at Marlborough House. 'Tis a wonderful thing certainly. Who will buy it, I wonder; it is worthy the pen of him who wrote of that other diamond necklace which helped to cost the French Queen her crown and her head, or of that still more sublime imagination which created Mr. Ruby's "ropes of pearls."—"*Atlas,*" *in the World.*

Mr. John Watkins, of South Kensington training, has again obtained the annual prize of £50 awarded by the Goldsmiths' Company for the best design for a work in precious metal, either in *repoussé* or chased. The design by which Mr. Watkins won this distinction, was declared by Mr. Poynter to be the most remarkable that had ever been sent in for competition. The subject chosen by the artist is the shield of Aeneas, forged by Vulcan, and embossed by his prophetic knowledge with representations of the future triumphs of Rome (Virgil, Book VIII.) In the centre of the design, the artist has depicted the naval battle of Actium, as being the most terrible, perhaps, in which the Romans were engaged; and round this he has traced, in different compartments, the various episodes of Roman history from the legend of Romulus and Remus to the triumph of Augustus, the whole being set between two circles of richest ornamentation.

COMPETITIVE CHRONOMETER TRIALS AT GENEVA, 1876-77.

Professor Plantamour reports:—This year's competitive trials have again given very good results. The following were the conditions imposed, and which were not quite so rigorous as those of last year.

1. Mean daily rate, not to exceed 1 second per day.
2. Variation in 6 positions, not to exceed 3 seconds during the 7 days' trial.
3. Error in compensation produced by differences in temperature, not to exceed 0·33 second per degree.

A special prize was offered for a collection of 6 chronometers belonging to the same firm, and giving the best mean results. Out of 63 chronometers, 41 underwent the required tests successfully. This proportion of 41 to 63, that is about two-thirds, is the usual one. So at the international trials of last year out of 82 chronometers submitted, 55 fulfilled the conditions of the trials.

These 41 chronometers were supplied by 11 different firms, the well-known houses of H. R. Ekegren, Alexis Favre, Patek, Philippe and Cie, being represented by 6, 7, and 10 chronometers respectively. If we take the mean variation of these 41 chronometers, for each of the three tests, we obtain very satisfactory figures

The mean variation for the 1st trial was ± $0^s,499$.
For 4 chronometers, $0^s,25$; $0^s,25$; $0^s,26$; $0^s,27$.
For the 2nd trial ± $1^s,672$.
In 4 chronometers, $0^s,33$; $0^s,50$; $0^s,77$; $0^s,88$.
For the 3rd trial ± $0^s,104$.

For 3 chronometers the error in compensation was nill, or at least, under half a hundreth of a second per degree.

Last year's figures were:—

For the 1st trial ± $0^s,544$.
For the 2nd trial ± $1^s,68$.
For the 3rd trial ± $0^s,123$.

H. R. Ekegren was the most successful competitor, the 6 chronometers submitted by him gave a mean variation of ± $0^s,455$; $1^s,033$; $0^s,087$ for the 1st, 2nd, and 3rd trials respectively, the special prize for the 6 best chronometers was therefore awarded to him.

QUERIES AND REPLIES.

H. S. asks, through a contemporary, "How can I make a platinum chain? How can I melt platinum?"

A.—Pure platinum can only be fused by the aid of the oxyhydrogen blowpipe. Place the metal in a small cavity cut out of a piece of pure caustic lime, and cause the flame to impinge upon it strongly until fused. The hottest part of this flame is, when the gases are properly proportioned, within a quarter of an inch of the mouth of the blowpipe.

E. A. asks:—"In what position between the lenses which constitute the eyepiece should the diaphragms be placed?"

A.—In the combination at the eye end, it should be in the focus of the eye lens; in the other combination Fraunhofer placed it in the middle. The French opticians place it about six-tenths of the distance between the two lenses, toward the eye end.

S. S. C. asks:—1. "In a silver plating bath, should the surface of anode immersed equal the surface of cathode?" *A.*—They should be about alike. 2. "Is there any way of testing the amount of free cyanide in a plating solution?" *A.*—Yes. See Sprague's "Electricity; its Theory, Sources, and Applications." 3. "In a nickel ammonia sulphate solution, does the ammonia or acid act upon the nickel anode to keep the strength of the solution up?" *A.*—The acid.

M. C. H. asks:—"I am building a time regulator, and want to make a mercurial compensating pendulum to beat seconds. The rod is to be of steel, and the bob a glass tube filled with mercury. At what height must the mercury stand in the tube to compensate correctly?"

A.—You will have to determine the exact height by experiment. It will probably be between 6½ and 6¾ inches.

F. W. J. asks:—"Can you give me a recipe for a gold wash for watch chains, &c.?"

A.—Clean the articles perfectly, and wash them in a strong neutral bath of chloride of gold in warm water. Then dip for a moment into moderately strong solution of copperas, dry, and polish. Or use an etherial solution of chloride of gold, dry, and reduce by contact with hydrogen gas (coal gas will answer) in a tight apartment. Or dip in the gold solution first mentioned, and then in a hot solution of caustic alkali.

Brass.—Watherston & Son, 12, Pall Mall East, will supply you with what you require.

PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

2079. John George Henry Hoch, of 283, Brixton-road, n the county of Surrey, watch and clock manufacturer, and Carl Johann Heinrich Friederich Dagobert Obach, of 314, Brixton-road, in the county aforesaid, picture dealer and print seller, for an invention of "Day and night dial watches based upon the principle of a twenty-four hours division of time."—Dated 29th May, 1877.

2127. Thomas William Jones, junior, of the City-road, London, in the county of Middlesex, watch manufacturer, for an invention of "Improvements in fasteners or suspenders for neck-ties, scarves, and other similar articles of wearing apparel."—Dated 1st June, 1877.

2182. Joseph Mortimer Granville, of Savile-row, in the county of Middlesex, doctor of medicine, Licentiate of the Royal College of Physicians, for an invention of "Improvements in thermometers and spirometers."—Dated 5th June, 1877.

2272. Gustave Fauvel, optician, of Rouen, for an invention of "Improvements in and applicable to spectacles and other glasses to be worn on the nose."—Dated 11th June, 1877.

2285. Frederick William Kuschmann, of 18, Bunhill-row, St. Luke's, and Leopold Hirschfeld, of 3, Spencer street, both in the county of Middlesex, manufacturers, for an invention of "A new mechanical fastener for dresses, scarves, and other useful purposes.'—Dated 12th June, 1877.

2324. Charles William Cooper, of Birmingham, in the county of Warwick, electro-plater and gilder, and Reuben Cornelius Lilly, of Birmingham aforesaid, jeweller, for an invention of "Improvements in watch protectors, which improvements may also be used for protecting lockets, charms, chains, and other like articles of jewellery.'—Dated 14th June, 1877.

2346. Benjamin Martin Petersen, of Mark-lane, London, merchant, for an invention of "Improvements in fastenings for studs, solitaires, and other similar articles."—Dated 15th June, 1877.

2360. George List, of Handsworth, in the county of Stafford, Agency Inspector of the Life Association of Scotland, and George Rowland List, of Handsworth aforesaid, manufacturing jeweller, for an invention of an "Improvement or improvements in suspenders for lockets and other like articles of jewellery."—Dated 16th June, 1877.

2467. Peter Jensen, of Chancery-lane, London, for an invention of "A new or improved pneumatic precision clock with lever escapement and worked hydro-pneumatically."—A communication to him from abroad by Carl Albert Mayrhofer, of Vienna, Austria, Engineer.—Dated 26th June, 1877.

2505. Frederick Eade and John William Blake, both of Birmingham, in the county of Warwick, for an invention of "Certain improvements in the manufacture of plated edge seals, keys, and spring keys, medals, and edged charms, and other similar articles."—Dated 28th June, 1877.

Notices to Proceed.

442. Charles Moreau, optician, of the city of Paris, in the republic of France, has given notice in respect of the invention of "Improvements in opera, field, and marine glasses."

530. William Robert Lake, of the firm of Haseltine, Lake, & Co., patent agents, Southampton-buildings, London, has given notice at the office of the Commissioners of his intention to proceed with his application for Letters Patent for the invention of "Improvements relating to the working, regulating, and winding-up of clocks, chiefly designed for controlling a series of clocks by pneumatic power."—A communication to him from abroad by Victor Popp, Ernest Resch, and Charles Albert Mayrhofer, as representatives of the "Gesellschaft zum Betriebe pneumatischer Uhren, of Vienna, Austria.

Inventions protected for Six Months on the deposit of Complete Specifications.

2241. Henry Keevil, of 1, Edward-street, Bath, in the county of Somerset, praying for Letters Patent for the invention of "Producing the optical effects known and called the 'dissolving scenes' by means of a new optical adaptation for that purpose," was deposited and recorded in the Office of the Commissioners on the 8th day of June, 1877, and a Complete Specification accompanying such petition was at the same time filed in the said office.

Grants of Provisional Protection for Six Months.

1320. To John Wall, jeweller, of Birmingham, in the county of Warwick, and James Newman, jeweller, of Small Heath, near Birmingham aforesaid, for the invention of "Certain improvements in constructing, adapting, and applying dress fasteners to various parts of dress for ladies' or gentlemen's use."

2026. To Louis Platnauer, of Birmingham, in the county of Warwick, for the invention of "Improvements in fastenings for buttons, shirt studs, solitaires, and other articles of jewellery and dress."

1853. To Louis Beaver, of Manchester, in the county of Lancaster, goldsmith, for the invention of "Improvements in scarf-rings."

2127. To Thomas William Jones, junior, of the City-road, London, in the county of Middlesex, watch manufacturer, for the invention of "Improvements in fasteners or suspenders for neck-ties, scarves, and other similar articles of wearing apparel."

2243. To Richard Heathfield, of Birmingham, in the county of Warwick, manufacturer, for the invention of "An improvement or improvements in apparatus or machinery used in galvanizing sheet iron, or coating sheet iron with zinc or alloys of zinc."

2285. To Frederick William Kuschmann, of 18, Bunhill row, St. Luke's, and Leopold Hirschfeld, of 3, Spencer-street, both in the county of Middlesex, manufacturers, for the invention of "A new mechanical fastener for dresses, scarves, and other useful purposes."

2182. To Joseph Mortimer Granville, of Savile-row, in the county of Middlesex, Doctor of Medicine, Licentiate of the Royal College of Physicians, for the invention of "Improvements in thermometers and spirometers."

Patents Sealed.

1299. Benjamin Joseph Barnard Mills, of the firm of Harris and Mills, of 23, Southampton-buildings, in the county of Middlesex, patent agent, for an invention of "Improvements in time globes."—A communication to him from abroad by Louis Paul Juvet, of Glen's Falls, in the county of Warren and state of New York, United States of America.—Dated 3rd April, 1877.

725. Charles Denton Abel, of 20, Southampton-buildings, Chancery-lane, in the county of Middlesex, for an invention of "An improvement in composition-alloys."—A communication to him from abroad by Frank Raymond, of Greenville, South Carolina, United States of America.—Dated 22nd February, 1877.

5002. William Robert Lake, of the firm of Haseltine, Lake, and Co., Patent agents, Southampton-buildings, London, for an invention of "An improved machine for engraving and chasing jewellers' and silversmiths' work, and for other like purposes."—A communication to him from abroad by Albert H. Watkins and Frederick A. Brown both of Boston, Massachusetts, United States of America.—Dated 27th December, 1876.

911. Robert Hadfield, of Southampton-buildings, Chancery-lane, London, for an invention of "Improvements in the manufacture of steel.' —Dated 7th March, 1877.

29. William Gillett and Charles Bland, both of Croydon, in the county of Surrey, clock manufacturers, for an invention of "Improvements in clocks and other time-keepers."—Dated 2nd January, 1877.

455. Henry Percy Holt, of Royal Insurance Buildings, Leeds, in the county of York, civil engineer, and William Denison, of West-street, Leeds, in the county of York, engineer, for an invention of "Improvements in fire and burglar proof safes, more particularly in connection with shop windows, and in the apparatus connected therewith."—Dated 2nd February, 1877.

Patents which have become Void.

1953. William Edward Wiley, of Birmingham, in the county of Warwick, for an invention of "Improvements in the manufacture of movements for pencil cases and other articles having similar movements."—Dated 5th June, 1874.

2064. Alexander Parkes, of Gravelly Hill, near Birmingham in the county of Warwick, for an invention of "Improvements in the manufacture of metallic alloys."—Dated 13th June, 1874.

Patents Granted in Foreign States.

France.

116,051. Fritsch & Forster, for "A telescope."—Dated 18th December, 1876.

116,062. Moreau, for "An opera-glass with variable widening."—Dated 18th December, 1876.

116,068. Spuhler-Jeanneret, for "An eight-day watch."—Dated 18th December, 1876.

116,078. Charpentier & Mallie, of Paris, for "Treatment of the residues of nickel and other metals by the dry way."—Dated 20th December, 1876.

116,120 Favre, of Paris, for "Applying portraits or other subjects on watches and jewellery by means of charcoal-photographs."—Dated 21st December, 1876.

116,156. Madelaine & Van Blotaque, for "A metallic casket for jewellery."—Dated 23rd December, 1876.

116,183. Gesland, for "Trinkets, sleeve-links, medallions, scent-boxes, &c."—Dated 26th December, 1876.

116,210. Collin, of Paris, for "Public alarm-clocks with recording apparatus."—Dated 30th December, 1876,

116,219. Jeeferys, for "Clasp-buttons for jewellery and other purposes." —Dated 30th December, 1876.

116,238. Triefus & Ettlinger, for "A single eye-glass."—Dated 29th December, 1876.

Certificate of Addition.

115,867. Richard, for "Improvements in the construction of aneroid barometers."—Dated 21st December 1876.

Italy.

12. Domon, of Bienne, Switzerland, for "A so-called 'unique watch.'"—15 years.—Dated 6th January, 1877.

29. R. Francois, of Naples, for "A cosmochronograph or clock indicating at once the time of different different parts of the globe."—3 years.—Dated 28th December, 1876.

72. A. Spuhlert-Jeanneret, of Chaux-de-Fonds, for "An eight days remontoir."—6 years.—Dated 12th February, 1877.

Certificate of Addition.

7. B. Durante, of Genoa, for "A free escapement for clock-work."—Dated 13th January, 1877.

Belgium.

42,045. J. J. B. J. Lebas, for "A lateral column escapement with a flat inclined wheel."—Dated 25th April, 1877.

42,122. C. Henard & E. Lasnier, for an imported invention of "A cosmographic clock."—Dated 4th May, 1877.—(French Patent, 12th February, 1877.)

Prussia.

18. J. H. F. Prillwitz, of Berlin, for "A machine for lacquering metal cases."—3 years.—Dated 13th April, 1877.

24. P. Ehrlich, of Golis, near Leipzig, for "An arrangement of musical boxes."—3 years.—Dated 13th April, 1877.

57. O. Welter, of Berlin, for "A burglar firing alarm."—3 years.—Dated 28th April, 1877.

64. A. Moser, of Aix-la Chapelle, for "A dioptrical precision apparatus for telescopes employed for measuring angles."—3 years.—Dated 30th April, 1877.

United States of America.

184,218. William C. Spellman & Francis A. Goeltz, of New York, N.Y., assignors to said Spellman & C. M. Rowley, of Boston, Mass., for "Advertising-clocks."—Application filed 10th October, 1876.

185,173. Jos. Fortenbach, of Carlstadt, N J., for "Dies for making watch-case bezels."—Application filed 7th May, 1875.

185,174. Jos. Fortenbach, of Carlstadt. N.J., for "Dies for making watch-case centers"—Application filed 7th May, 1875.

185,172. Jos. Fortenbach, of Carlstadt, N.J., for "Dies for making watch-case backs."—Application filed 7th May, 1875.

185,323. C. Holes, of Ridgway, Pa., for "Escapements for watches."—Application filed 15th November, 1876.

184,967. W. Imhaeuser, of Brooklyn, N.Y., assignor to Elise Imhaeuser, of the same place, for "Watchmen's time-detecters."—Application filed 19th October, 1876.

184,972. F. Kroeber, of Hoboken, N.J., for "Clock-movements."—Application filed 2nd November, 1876.

185,016. E. M. Corwin, of Barry, Ill., for "Compensating-pendulums."—Application filed 30th October, 1876.

185,047. J. E. Rettig, of Washington, D.C., for "Electric governors for motors, clocks, &c."—Application filed 9th May, 1876.

Designs Patented in the United States.

9616. Henry Carlisle, jun., of Philadelphia, Pa., for "Bracelets."—Application filed 5th October, 1876.—Term of patent $3\frac{1}{2}$ years.

9659. Jacques Laurent, of New York, N.Y., for "Watch-cases."—Application filed 14th October, 1876.—Term of patent 7 years.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Adams, Jabez, Church-street, and High-street, Ripley, Derbyshire, watchmaker. May 28. C. B. Hodgson, sol., 13, Waterloo-street, Birmingham.

Eccles, Thos., 1, Park-place, Stour-street, Birmingham, and 46b, Augusta-street, Birmingham, jeweller. June 1. T. C. Cheston, sol., 148, Moor-street, Birmingham.

Harrison, Francis, Morpeth, Northumberland, watchmaker and jeweller. May 30. T. Nicholson, sol., Morpeth.

Martin, Wm., 76, High-street, Guildford, watchmaker and jeweller. June 2. G. Durbidge, sol., Guildford.

Rozner, Isaac, Bridge-street, West, Middlesborough, jeweller. May 29. J. H. Hope, sol., Middlesborough.

Baumann, Chas. Henry, Carrington-street, Nottingham, watchmaker and jeweller. May 29. W. H. Stevenson, sol., Nottingham.

Brown, Joseph, Myton-gate, Hull, jeweller. June 7. E. Laverack, sol., Hull.

Goode, Nathaniel, 1, Cromwell-street, Earlsdon, near Coventry, watch manufacturer. June 6. Hughes & Masser, sols., Coventry.

Kaufmann, Siegmund, 97, Hatton-garden, importer of watches. June 6. Lewis & Lewis, sols., 10 Ely-place, Holborn.

Burn, Wm., Briggate, Leeds, clock case maker. June 14. E. F. Maud, sol., Leeds.

Cole, Chas. Jno., Queen-street, Wolverhampton, jeweller. June 15. R. R. Rhode, sol., Wolverhampton.

Davies, Wm., High-street, Ebenezer, Carnarvon, watchmaker. June 14. J. B. Allanson, sol., Carnarvon.

Hayman, Marcus, 7, North-crescent, Bedford-square, late Norfolk-street, Strand, and Argyle-square, prev. Durban, Natal, dealer in diamonds and jewellery. June 7. L. Goldberg, sol., 1, West-street, Finsbury-circus.

Grabowsky, Philip, 40, Chatham-street, Leicester, dealer in jewellery. June 14. T. Wright, sol., Leicester.

Kipper, Fredk., 1, Cumberland-terrace, Bouverie-road, Stoke Newington, watch importer. June 7. L. Barnett, sol., 6, Palmerston-buildings, Old Broad-street.

Lange, Christian, 99, Strand, watch and clock manufacturer. June 11. C. H. Hodgson, sol., 10, Salisbury-street, Strand.

Vickers, Isaac, Market, Lancaster, watchmaker. June 11. Clark & Oglethorpe's, sols., Lancaster.

Wright, Fredk., Bath-passage, Smallbrook-street, Birmingham, and Edwards-street, Balsall-heath, clock manufacturer. June 15. A. B. East, sol., Eldon-chambers, Birmingham.

Crundell, Walter John, 6, Broad-street, Leominster, watchmaker and jeweller. June 22. At H. Moore's, sol., Leominster. July 11 at 3.

Hawkins, Joseph Millington, trading as Joseph Hawkins, 56, Tenby-street, North, Birmingham, manufacturing jeweller. June 19. At M. J. Blewitt's, sol., 5, Waterloo-street, Birmingham. July 5 at 11.

Horwood, James Henry, 41, Gibson-square, Islington, metal merchant. June 21. At W. G. Payne's, sol., 5, Serjeants'-inn, Temple. July 6 at 3.

Jackson, William Edward, Halifax, jeweller, &c. June 18. At Burrell & Pickard's, accountants, Leeds. July 5 at 3. W. Brown, sol., Leeds.

Adjudications of Bankruptcy.

Michael, James, Rattray-road, Brixton, jeweller's factor. June 22. Murray, reg.

Atkinson, Thomas Weatherby, Buccleuch-street, Barrow-in-Furness, Lancashire, jeweller.

Trustees Appointed.

Curry, Robt. (Liq.), Spennymoor, watchmaker. Tr., J. C. Pigg, Bishop Auckland, accountant.

Marks, Simon (Bkt.), 31, Westmoreland-terrace, Newcastle, jeweller. Tr., H. Cohn, 93, Leadenhall-street, London, merchant.

Trustees Deeds Granted.

Gillies, J. & H., 21, Cowcaddons, Glasgow, watchmakers and jewellers, and Hugh Gillies, the sole partner. Claims with Barr & Carstairs, 43, Renfield-Street, Glasgow, accountants, by July 7.

Discharges Granted and Bankruptcies Closed.

Keller, Philip, & Emil Hahn (Bkt.), Hatton-garden, London, and Birmingham, dealers in precious stones. Discharge granted June 1.

Mills, Wm., Wills-street, Hunter's-lane, Birmingham, clock manufacturer. (A div. of 11d. has been paid.) Bankruptcy closed June 8.

Dissolutions of Partnerships.

Enterprise Watch & Jewellery Co., 135, and 137, Argyle-street, Glasgow. May 18.

Stevenson & M'Arthur, 421, and 423, New City-road, Glasgow, watchmakers, &c. June 5. Debts by B. R. Stevenson, who continues the business.

Hooper & Allen, Duke-street, Cardiff, watchmakers and silversmiths. March 31. Debts by W. A. Allen.

Lowe & Sons Gloddiarth-street, Llandudno, silversmiths and jewellers. June 2.

Marriott & Co., 386, Oxford-street, clockmakers. May 12. Debts by D. Marriott.

Peachey, Grimley & Furneaux, 16, Tottenham-court-road, jewellers. August 12.

Peters, John James & Co., College-green, Bristol, gold and silversmiths and watchmanufacturers. March 31. Debts by T. T. Taylor.

Thwaites Bros., 25, St. John-street-road, Clerkenwell, clock dial painters. May 16. Debts by James Thwaites.

Wherly, M. & S., 85, High-street, West, Sunderland, and trading as S. Wherly, Hume-street, Stockton-on-Tees, jewellers. May 11.

Distribution of Assets.

Uglow, William, Newton Abbott, Devon, silversmith, died May 20. Claims by July 2 to H. G. Beachy, Newton Abbot, sol.

Last Days for Lodging Claims.

Williams, Alfred, trading as A. Williams & Co., (Bkt.), Branston-street, Birmingham, manufacturing jeweller. Claims by July 7 to S. Dominy, Waterloo-street, Birmingham.

THE
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A MONTHLY TRADE JOURNAL,

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SPECIAL NOTICE.

COMMENCEMENT OF OUR THIRD VOLUME.

IT is with no ordinary satisfaction that we (with the present Number) enter upon the third year of the publication of this Journal, which has already established for itself the reputation of being the recognized organ of the various trades represented by our pages.

Modesty prevents us applying the motto, "*Success the Reward of Merit;*" nevertheless, we may say that as we sit at our editorial desk and reflect on the past history of our young Journal, a feeling of (we trust pardonable) pride arises within us, when we consider the many encouragements and expressions of satisfaction with which our endeavours have been attended.

Although we do not desire to sound our "own trumpet," we can yet conscientiously say that the usefulness of this Journal is quite evident from the fact of its circulation steadily increasing. At its first appearance, it had to "introduce *itself*" to the trade, many of whom hailed it at once as a WELCOME VISITOR, but feared that scarcely sufficient nourishment would be found to sustain it. Such fear, has, however, we are glad to say, proved groundless; and from a small circulation it has grown larger and larger, until it now counts among its patrons subscribers *in all parts of the world*. Scarcely a week passes without our receiving communications from the Colonies and different quarters of the globe, expressing high appreciation of our endeavours, accompanied with requests to be supplied with the Journal, which gives us additional encouragement in our work. We enter upon our Third Volume with earnest hope that the confidence hitherto received will be continued, and that increased support will rally around us in our determination to fulfil our duty as journalists, by endeavouring to place before our readers a TRADE JOURNAL WORTHY of their PATRONAGE. Such will be the aim kept in our view, and one which we hope will be found fully realized.

To those of our subscribers who have not yet forwarded their annual subscription for the ensuing volume, we would say, "NEVER POSTPONE TILL TO-MORROW WHAT YOU CAN ACCOMPLISH TO-DAY." The amount is trifling, the trouble still less; procure a Post Office Order for FIVE SHILLINGS, address it to our office, and be sure of receiving in return FULL VALUE in instructive and interesting information necessary to EVERY man in the trade.

Mr. Herman Bush, of 14, Mytongate, Hull, has undertaken the agency of this "Journal" in that town and surrounding district, and is fully authorized to receive subscriptions, and to arrange for advertisements in our behalf.

THE NEW GERMAN PATENT LAW.

THE new "Imperial Patent Law," which has just been passed by the Reichstag, has come into force the 1st of this month. It is a very desirable alteration, and puts an end to the disorder concerning patents in Germany; as up to the present there were no less than twenty-one different States granting patents of their own. The new law is a very practical one, and far better than many now in force in other countries. An invention must be novel, and not have been introduced to the public, so that any other person could have imitated it. Imported inventions are only patentable to the real inventor. It is unlawful to manufacture a patent article, to import the same from another country, or even to use a patented machine, tool, apparatus, or process. Any one having an invention in use cannot be prevented from continuing to use it. The new term of patent is fifteen years. The taxes are £2 10s. for the first year, same amount for the second, £5 for the third, and so on, with an addition of £2 10s. yearly; thus a fifteen years' patent costs £265 altogether. Patents of additions are granted at a cost of £2 10s. The taxes can be paid three months after date. Patent rights may be withdrawn by the Government after three years, if the invention has not been carried into operation to a proper extent, or if the inventor has not taken the necessary steps to carry the patent into effect: if he refuses licenses to others who offer a fair royalty, and it is advisable for the public good to grant such licenses. Any one having obtained a patent for improvements on an article already patented, and wanting a license from the first inventor, is obliged to give the latter a license for his improvements. Foreign inventors must empower a German citizen to make their applications. The applications will be examined by the patent commissioners and experts appointed for this purpose; an appeal can be made, in case of refusal, to a special commissioner, and from him to the Imperial Court at Leipzic. In the case of poor inventors, the payment of taxes will be postponed for two years, or altogether remitted. Specifications and drawings can be inspected immediately after the application; on account of this, patents should be taken in other countries first. Patents being delivered, a short specification of the same will be published in the "Patent Journal." Before the lapse of a patent, notice has to be given to the inventor, and a proper time allowed him to fulfil the requirements of the law. Infringements of patent-rights are punished with a fine not exceeding £500, or imprisonment not exceeding one year. Describing articles as patented which are not so is punishable with a fine of £7 10s. At the publication of the inventors, any one thinking he has a prior right may enter an opposition, which is then examined in the presence of those concerned. Existing German patents may be transferred to the Empire, but cannot be prolonged.

CLEANING WATCHES.

A CORRESPONDENT of the New York *Jewellers' Circular* says:—"I have tried all of 'Excelsior's' ways of cleaning watches, and some few others, and do not find any of them as satisfactory as the following. It may seem like a good deal of trouble at first sight, but after a long and careful trial by myself, I think it will prove satisfactory to all who give it a fair trial. After taking down the watch, including end stones, mainspring, barrels, &c., take each piece and wash thoroughly with castile soap and soft (rain) water; drop them as soon as done into clean water. When all have been gone over in this way, take each piece from the rinsing water, brushing with the same brush or some other clean one in order to remove all the soap, dropping each piece in alcohol, except the lever and balance, if the roller and jewel is left on, which should be dipped into benzine. Dry with clean soft rags, as per directions by 'Excelsior,' this does not injure the most delicate gilding if good alcohol and soap are used, and does away with handling with watch papers while cleaning, except cleaning the holes with pegwood. The screw holes and sinks do not retain chalk by this method. I obtained this method from an ex-factory employè, who was well up in the scientific as well as the practical part of horology."

ENGLISH, AMERICAN, FRENCH, AND GERMAN Periodicals, and recently published Handbook for Refiners, Jewellers, Electroplaters, Watchmakers, and Lapidaries. List free on application to Herman Bush, American Clock Depot and Publishing Agency, Hull, Yorkshire.

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HOROLOGY.

(*Continued from page* 1.)

XXVI.—On the Measurement of Time.

MOST astronomical operations depend upon precision in the measurement of time. Their object is either to ascertain the position of a star at a certain moment, to measure the interval which separates two phenomena, or to determine the duration of one. They often require a perfect harmony between the indications of two clocks distant from each other; and, in short, they are based on the hypothesis of a perfect regularity in the apparatus employed. The same may be said as regards the ascertaining of longitudes at sea. As is well known, one way of solving this problem is to take the time when the longitude is to be ascertained, an operation for which astronomy supplies sufficiently exact means, and to compare it with the time indicated at the same moment under the meridan under which the longitude is to be obtained. The difference of time, reduced to geographical degrees and fractions of degrees, gives the desired longitude; but this proceeding supposes the observer in possession of a chronometer or watch which has not varied by the removal. The solution of this problem was of such vital interest to navigators, that countries with a maritime commerce gave great encouragement to mechanicians in constructing those instruments known as *marine timekeepers*, or *chronometers* with sufficient precision. This subject is one of those which was entrusted to the special care of a "*Board of Longitude* in England and to a *Bureau de Longitude* in France. These committees consisted of astronomers and mechanicians, whose duty it was to draw up the necessary astronomical tables, and to have an eye on everything that might perfect the systems in use for that purpose. To give an idea of the degree of favour these researches enjoyed, it may be mentioned that the English Parliament, on the recommendation of a committee, of which Newton was a member, voted a sum of £20,000 for the invention of a marine timepiece which would not vary more than two minutes in forty-two days, thus procuring the longitude at sea by half a degree at the end of that time. Considerable sums were also proposed by other Governments.

In some requirements, astronomical clocks and chronometers corresponded with marine timekeepers, but differed in others, their uses, and therefore, also, the conditions demanded of them, being different. The astronomical clock, destined to remain a fixture, could retain weight as motor, and the pendulum as regulator. The mechanism of the latter and of the escapement was, however, capable of improvement. We have already said that the oscillations of an ordinary pendulum in arcs of greater amplitude are not sufficiently isochronous, and it was in trying to remedy this defect that Huyghens invented the cycloidal pendulum. The latter could not be abandoned without suffering again from the fault mentioned, because the escapement with balance wheel makes the regulator necessarily oscillate in large arcs. It was, however, superseded by the invention of a new escapement allowing minute movements. In 1680, the *anchor escapement* made its appearance in London, which answered those conditions: this invention is attributed to an English watchmaker named *Clement*. *Graham* perfected it thirty years later, and, by evading the recoil impressed on the scapewheel by each oscillation of the pendulum, he procured to the pendulum clock the advantage of a dead-beat escapement, which had already been obtained for the balance. These escapements underwent further modifications in France by *Le Roy* and *Le Paute*, so as to make them applicable to astronomical clocks. But *Berthoud*, a Swiss watchmaker, went still further, and to him belongs a large share in the remarkable progress in astronomical clocks. The movement of the regulator was kept up by the action of the principal motor; but if this action continued by friction while the escapement was at rest, some irregularity must have arisen in the oscillations. The cause of this irregularity was reduced by the introduction of the chronometer escapement, in which the regulator receives only a momentary impulsion from the motive force. Le Roy and Berthoud seem to have had the idea of this invention simultaneously; but it was the latter who applied it to astronomical clocks. Horologists were, however, striving to obtain an absolute independence of the regulator from the motive power, and this object was gained with greater perfection by the *remontoir escapement*. By this escapement a special motor was established between the regulating system and the last wheel of the machine, which caused the "rise" by a constant impulsion of its own, the action being simply renewed, but in no manner modified by the motive force. Huyghens and Leibnitz had already the idea of the *remontoir*, but the imperfection of the then existing movement would not permit the realization of their idea; it required all the ingenuity of modern appliances to make it work.

The ease with which the movements of clocks, destined for observatories, were observed, did not fail to reveal that they were under the influence of heat or cold. It was ascertained that the higher the temperature the slower the movement. Physics had already made sufficient progress to explain this influence and to suggest a remedy. The dilatation, which heat causes in metals was known for a long time, and it was understood that the oscillations of the pendulum at a high temperature were slower on account of this extension. Huyghens had previously used the aid of geometry to perfect the pendulum, and physical science was now appealed to in correcting this recognized defect. *Graham* was the first to enter the lists, and he was followed by *Harrison* in England, by *Cassini*, *Le Roy*, and later, by *Berthoud*, in France. We cannot too much admire the skill with which these different mechanicians fought against this difficulty. Without entering into particulars of their inventions, it will suffice to say that all of them profited by the known differences in the dilatation of different metals, and tried to combine them in the construction of the pendulum in such a manner as to obtain a fixed length from the centre of oscillation by the opposition the metals offered in extending. This process was called "compensation."

Improvements in marine timekeepers, which received such substantial encouragement, have the advantage of perfecting also the ordinary watches; so that the efforts made in behalf of geographers and mariners turned out for the benefit of all who care to keep an exact account of their time. Watches suffered more derangement from friction, their wheel-work being more delicate and their motors less powerful. In 1700, the method of drilling in *rubies* the holes destined to receive the pivots of the balance, was invented by a Swiss resident in London, *Nicolas Fatio De Duillier*, a learned and ingenious man, who but for his turbulent spirit and unhappy character, might have ranked among the first geometricians of his day. His process, which had attracted the attention of Newton, was immediately put in practice by *De Bauffie*, a French watchmaker also established in London. An interesting incident is attached to this invention which T. W. Benson in his "Time and Time Tellers" relates as follows:—

"In May, 1705, *Fatio* and the two brothers *Peter* and *Jacob De Bauffie* obtained a patent for the above invention to extend over fourteen years. In December, 1705, he petitioned (as we presently see) to be granted a more extended term, and then the Clockmakers' Company opposed the application upon the ground of the invention not being a novel one, and in proof of their statement produced the watch made by *Ignatius Huggeford*, a member of their own Company, some time before the application of the pendulum-spring. As this watch had a large amethyst mounted upon the cock or pivot of the balance-wheel, the Committee of the House of Commons were induced to decide against Fatio's petition, and to throw out his Bill. This watch has since then obtained an extensive historical reputation, and it is preserved in the archives of the Clockmakers' Company as one of their most valuable treasures, for it is the earliest known English jewelled watch, and is the identical instrument produced before the House of Commons Committee as evidence to upset, and which did upset poor Fatio's claim for an extension of patent. Alas, for ancient reputations, it has been but recently discovered that Huggeford's watch was but a fraud, and that the jewel in the cock which deceived the Parliamentary Committee into supposing that Ignatius Huggeford, an Englishman, had applied jewels to watches long before Fatio had been heard of, *has nothing to do with the working* of the watch. The jewel has been merely stuck on, just in the place where a jewel should be; but as it is only fixed to the surface of the brass and no pivot plays in the jewel, it may be averred that the amethyst had no more to do with the movement than the silver ornaments on the watchcase. It is clear by the words in Fatio's petition that his application of jewelling to watches was not merely done with the idea of ornamenting them—in that there would have been no novelty—and it seems probable that the amethyst would have been placed upon the face of the watch if the object of inserting it anywhere had simply been ornamentation. The story is a very extraordinary one, for it must have been a miraculously curious whim which possessed Huggeford to insert a jewel as an ornament in a place where it would not be seen, and still more wonderful that it should have been placed exactly where it should suit the purpose of after litigation."

The use of precious stones was then extended to other parts of the movement with great advantage, wherever friction and wear had to be dreaded. *Sully*, to overcome the same drawbacks, tried to make the balance pivot turn between rollers; but it appears that this method did not prevail, as the use of rubies was continued. The escapement was of no less importance in marine watches than in astronomical clocks and many horologists exercised their skill in giving that mechanism the form most suitable to the instrument. *Tempion*, towards the close of the seventeenth century, constructed a new escapement which evaded the recoil; *De Bauffie* perfected it by its execution in diamonds, and *Sully* and *Berthoud* used similar escapements in their marine watches. At the same time, the cylinder escapement was introduced by the inventive genius of *Graham*, which, although inadmissible in marine timekeepers, found extensive application in the manufacture of watches. The successive inventions of the chronometer and remontoir escapement were introduced with great success in the construction of chronometers. Those two escapements were again altered in various ways by *Mudge* and *Arnold* in England, and *Berthoud* and *Breguet* in France. *Pouzait* presented to the Society of Arts of Geneva, the model of a chronometer escapement, strongly resembling Mudge's, three years before the latter had introduced his, that is in 1796. Several very ingenious remontoir escapements were also constructed by *Tavan*, another Swiss watchmaker, and exhibited at the French Institute (Section of Physical and Mechanical Sciences) in 1806.

A watch regulated by the balance is no more exempt from the influence of temperature than the pendulum clock; in fact, this influence makes itself felt here in two different ways; firstly, by altering the dimensions of the balance through dilatation and contraction, and secondly by changing the degree of elasticity in the spiral spring. Ingenious and delicate contrivances have been invented to remedy these disturbing causes as much as possible. Most of them are based on the bending movement which the variations in temperature occasion in a blade formed of two metals unequally dilatable. It was by the movement of this composite blade that *Harrison* first succeeded in tightening or loosening the spiral, and in approaching or distancing the oscillating body of the balance from its centre of suspension according to temperature; thus making use of this very influence to correct the disorder which it tended to cause in the working of the watch. *De Roy*, *Berthoud*, *Arnold*, *Breguet*, *&c.*, accomplished this difficult task after Harrison. We may also add the name of a Swiss, *Josias Emery*, who, in 1782, invented in London a special mechanism for compensating the balance. Pocket watches profited by the progress of marine timekeepers in everything that was applicable to them. *Turgensen*, a clever Danish watchmaker, profiting by a suggestion of Berthoud's, brought steel into general use in the manufacture of escapement wheels; Breguet applied the compensating balance to them, and made the escapement cylinder in rubies.

The degree of exactitude which has been obtained in the measurement of time is really astonishing; chronometers varying no more than a second a day are not uncommon. The contemplation of these marvellous machines involuntarily raises our admiration. The clever combination of ingenious contrivances, the extreme fineness of the various parts, the elegance and convenience of exterior form, the apparent mystery which hides the mechanism from our view and manifests the regularity of its results only; in short, everything impresses on these *chefs d'œuvre* of industry, a stamp of superiority, which gives the highest idea of the mechanician's art.

We have, so to speak, only enumerated the principal inventions which have led horology to this state of perfection but we shall supplement them with complete descriptions of the most important in our ensuing numbers.

(*To be continued.*)

DUTY ON GOLD OR SILVER PLATE.

From the Valuable Work of Mr. Chaffers on "Hall Marks."

1719. 6, George I.

A duty of 6d. per ounce troy was imposed on all silver plate, which should be imported or made in Great Britain.

1758. 31, George II., c. 32.

The former duty was repealed, and in lieu thereof, a duty of 40s. substituted; to be taken out by every person trading in, selling, or vending gold or silver plate; and the license to be renewed annually.

1759. 32, George III., c. 14.

The license was increased to £5 per annum, for every person trading in gold plate of two ounces, and silver of thirty ounces and upwards; persons dealing in gold and silver of less weight than two pennyweights of gold, or in silver, not exceeding five pennyweights, in one piece of goods exempted.

1784. 24, George III.

The annual license of £5 continued, and a duty of 6d. per ounce was again charged on all manufactured silver, the payment of which (as well as the subsequent increased duties) was, and is still indicated by a stamp of the reigning sovereign's head.

1797. 37, George III., c. 90.

By this Act the *duty* on gold was placed at 8s. per ounce, and on silver at 1s.

1803. 43, George III., c. 69.

The former Act of 24, George III., as regards the license, was repealed, and new licenses appointed, viz., for trading in gold more than two pennyweights and under two ounces; and in silver, over five ounces and under thirty ounces, £2 6s. per annum; for trading in gold of two ounces in weight and upwards, £5 15s. per annum.

1804. 44, George III., c. 98.

The duty was increased on gold to 16s. per ounce; on silver to 1s. 3d. per ounce.

1815. 55, George III., c. 185.

By this Act the duties were raised—on gold, to 17s. per ounce; on silver, to 1s. 6d., at which they still remain, watch-cases being exempted. Upon the exportation of plate (except gold rings and wares under two ounces) a drawback of the whole duty is allowed, provided that the plate be new and has never been used.

Further quoting from Mr. Chaffers, we find he says:—

The following gold and silver articles are exempted from control of assay offices:—Gold articles (12 Geo. II. c. 261) Jewellers' work, whereas any jewels are set (other than mourning rings) rings, collets for rings or other jewels, chains, necklace beads, lockets, buttons, hollow or raised, sleeve buttons, thimbles, coral sockets and bells, ferrels, pipe-lighters, cranes for bottles, small book clasps, stock or garter clasps jointed, very small nutmeg graters, snuff-box rims, whereof the tops or bottoms are made of shell or stone, sliding pencils, toothpick cases, tweezer cases, pencil cases, needle cases, filigree work, tippings or swages of stone or ivory cases, mounts, screws or stoppers to stone or glass bottles, ornaments small or slight, put in amber or other eggs or urns, seals wrought, seals in cornelian or other stones set therein. Any manufacturer of gold or silver so richly engraved, carved or chased, or set with jewels, so as not to admit of an assay to be taken of or a mark to be stuck thereon, without damaging, prejudicing or defacing the same. Things which by reason of there smallness or thinness are not capable of receiving the marks and not weighing ten dwt. of gold or silver each. Silver articles (30 Geo. III. c. 31). Chains, necklace beads, lockets, filigree work, shirt buckles, brooches, stamped metals, spouts to china, stone or earthenware teapots. The foregoing may be of any weight. Tippings, swages or mounts, weighing not more than ten dwt. of silver each, except necks and collars for castors, cruets or glasses appertaining to any sort of stands or frames (30 Geo. III. c. 31). All silver wares not weighing five dwt. of silver are exempt, *except* necks, collars and tops for castors, cruets, or glasses appertaining to any sort of stands or frames, buttons for wearing apparel, solid sleeve buttons, solid studs, not having a bevelled edge soldered thereon; wrought seals, blank seals, bottle tickets, shoe clasps, patch boxes, salt spoons, salt shovels, salt ladles, tea spoons, tea strainers, caddy ladles, buckles (short buckles or brooches before mentioned excepted), pieces to garnish cabinets or knife cases, or tea chests, or bridles, or stands, or frames.

Note.—All these articles are excepted, and are liable to be assayed, except watch cases are chargeable with duty.

CORRESPONDENCE.

It must be distinctly understood that we do not necessarily identify ourselves with the opinions or views of any of our Correspondents. Our pages are alike open to all for free discussion of questions connected with the various trades which we represent, and all Correspondents will find every opportunity afforded them for expressing their opinions.

THE SILVER DUTY.

To the Editor of The Watchmaker, Jeweller, and Silversmith.

Sir,—It will be interesting to your readers to learn that a further fall has occurred in the amount of manufactured silver plate during the year ended 31st of March, 1877.

The Inland Revenue returns are now before me. In the year ended March 31st, 1876, duty was paid upon 870,507 ounces; in the year ended March 31st, 1877, 798,206 ounces—a fall of 72,301 ounces, representing about £36,000 of wholesale trade. In 1855 duty was paid upon 994,360 ounces. After the lapse of nearly twenty-two years, one finds the silver trade of this great prosperous and rich country *reduced* by no less an amount than 196,154 ounces, roughly representing £100,000 of wholesale trade.

And yet manufacturers *of* 35 *years' standing* say, "If you take off the tax we shall all be ruined?" I appeal to you, sir, are they not being ruined now? Is their trade not a falling and a failing trade? But I am reminded that manufacturers in other trades were equally blind to their own interests, prior to the abolition of taxation. What did glass manufacturers say to Sir Robert Peel? What did paper makers say to Mr. Gladstone?—"We shall all be ruined." Happily they are not ruined yet! Neither will manufacturers of silver plate be ruined. No one ever is ruined by the abolition of taxation. To put a tax upon a trade may ruin a trade, but to take a tax off a trade must be to its manifest advantage.

I have the honour to be, sir,
Your obedient servant,
Pall Mall East, Edward J. Watherston.
July 24th, 1877.

Mr. Editor,—Seeing a letter on "Quacks of the Trade" in the Watchmaker and Jeweller for July 5th, I find that foolish people who go to quacks ought to pay for their learning. I find that quacks generally find us plenty of work, and augment trade rather than otherwise. I think what is wanted is a trade protection society throughout the whole United Kingdom, to either get the Plate License done away with altogether, or that the Inland Revenue officers should be compelled to catch those who are selling without a license. The wonder with me is how we here get a sale at all, there are so many selling without a license. There is not a village about here without two or three such traders. "We ought to be protected, if we have to be fined for selling without a license," as well as a publican being protected. Again, if the society for protection was formed, we might have a trade mark for jobs not worth doing. So that all might condemn it, and the owners then might get rid and buy a new one, thus increase trade, and be relieved from a deal of anxiety through worthless jobs. This letter is only a suggestion, perhaps some of your readers might devise some system. All other trades have a union, why not us?

Wellington Street, Yours,
Barnsley, Yorks. H. Park.
July 9, 1877.

Old Restrictions on the Clock Trade.—By the statutes of of the Corporation of Paris, authorized by Francis I., in the year 1544, jewellers were forbidden to deal in clocks, &c., unless acknowledged members of the Corporation. To this, persons were only admitted members on giving a full account of the art of clock-making, by examination and trial of their actual capabilities. Those only were eligible for the office of master who were of good life and morals, and had constructed a piece of clockwork to the satisfaction of the master with whom they had served their time as apprentice. All apprentices were to be bound by indenture for a term of not less than eight years. Visitors were appointed to inspect the workshops and establishments, and they were authorized to destroy all work either badly constructed or of inferior materials.

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from* p. 8.)

FROM this pernicious tax the Royal Family were exempt, as were also hospitals and churches, farm servants, soldiers, and sailors; nor did it extend to the stock of pawnbrokers and clock and watchmakers; but it required them to take out annually, at a cost of 2s. 6d., a license to sell those goods. The duty in a single year amounted to £48,820. But the Act was repealed in 1798, owing, it is said, to the representations of a committee of watchmakers convened in Clerkenwell, who proved to Mr. Pitt that a piece of work valued at £500 had been manufactured out of materials which did not in their rough original state cost so much as sixpence. Dr. Rees says, "This representation, we are credibly informed, induced the great statesman to abandon his plan of taxing an article, the value of which depended so much upon the ingenuity and labour, by which thousands were entirely supported; nay, further, on learning that the French and Swiss could afford to sell three gold watches for the price of one English one, the same minister took off the duty of 16s. per ounce from watch cases of that metal, and substituted 1s. the price of marking at Goldsmiths' Hall." In the years 1797 and 1798, the Clockmakers' Company appealed to Parliament respecting the severity of the Act. The petition was presented to the House on February 23rd, in the latter year by Alderman Lushington, M.P., and after being read, was referred to a Committee, with other petitions on the same subject. On the 27th, the Bill for repealing the duty in gold and silver watch-cases was read a third time, and passed up to the House of Lords. On March 14th, the Chancellor of the Exchequer stated in the House of Commons that the repeal of the Watch Act would cause a deficiency of £200,000, and as this tax was proved by experience to press heavily upon a very industrious and useful part of the community, he would, in order to meet the rules of the House, simply propose to repeal the tax on clocks, watches, and timekeepers; and on a future day bring forward another measure to meet such deficiency. His motion formally was, "that the tax on clocks, watches, and timekeepers, made last session, should cease and determine," which was agreed to. On the following day, Mr. Hobart brought up a report of this resolution of the Committee of the whole House, which was read and assented to. The Act imposing the duty had occasioned great distress among the watchmakers of Clerkenwell. On June 6th, 1814, Sir William Curtis presented a petition to Parliament from the clock and watchmakers, stating that they exported goods to the value of £500,000 annually, and that their trade was in danger of being ruined by the importation of foreign clocks and watches, to which the names of English workmen were affixed. In the years 1816 and 1817 great distress prevailed among the watchmakers of Clerkenwell, many of whom were reduced to the extremity of want. At no period since 1797 had there been such a lack of employment. The earnings of such as obtained work in the last three months of 1816 averaged 7s. 6d. per week. A philanthropic society was formed, and upwards of 3000 indigent workmen were relieved from its funds. Two pawnbrokers in Clerkenwell alone had watchmakers' tools in pledge to the amount of £190, a sum not exceeding one-third of their real value. This depression in the clock and watch trade was attributed to the extensive illicit importation of such articles from Geneva and other parts of Switzerland, the movements being brought over into this country, put into English cases, and then sold as English watches; while others were made up complete so as to resemble those of British manufacture. Babbage, writing in 1835, says that in the watch trade the practice of deceit in forging the marks and names of respectable makers had been carried to a great extent both by foreigners and natives; and the effect upon our export trades had been most injurious, as the following extract from the evidence before a Committee of the House of Commons proved:—

Question.—How long have you been in the trade?

Answer.—Nearly thirty years.

Q.—The trade is at present much distressed?

A.—Yes, sadly.

Q.—What is your opinion of the cause of that distress?

A.—I think it is owing to a number of watches that have been made so exceedingly bad that they will hardly look at them in the foreign markets; all with a handsome outside show, and the works hardly fit for anything.

Q.—Do you mean to say that all the watches made in this country are of that description?

A.—No; only a number which are made up by some low manufacturers. I recollect something of the sort years ago, of a fall off of the East India work, owing to there being a number of handsome-looking watches sent out, for instance, with hands on and figures, as if they showed seconds, and had not any work regular to show the seconds; the hand went round, but it was not regular.

Q.—They had no perfect movements?

A.—No, they had not; that was a long time since, and we had not any East India work for a long time afterwards. In the home market, inferior, but showy watches were made at a cheap rate, which were not warranted by the maker to go above half an hour—about the time occupied by the pedlar in deluding his country customers.

According to the census of 1861, there were 877 watch and clock makers in Clerkenwell.

The following two old proverbs relate to watches:—

"You may be a wise man, though you cannot make a watch."

"A man, like a watch, is to be valued for his goings."

The following story is told of Sheridan's stratagem to get a watch:—Harris, the proprietor of Covent Garden Theatre, who had a great regard for Sheridan, had at different times frequent occasions to meet him on business, and made appointment after appointment with him, not one of which was ever kept by Sheridan, who during his life wasted much of old Time's sand. At length Harris, wearied out, begged his friend Palmer, of Bath, to see Sheridan, and tell him that unless he kept the next appointment made for their meeting, all acquaintance between them must cease for ever. Sheridan expressed great sorrow for what, in fact, had been inevitable, and positively fixed one o'clock the next day to call upon Harris at the theatre. At about three o'clock he made his appearance in Hart-street, where he met Tregent, the celebrated French watchmaker, who was extremely theatrical, and had been the intimate friend of Garrick. Sheridan told him that he was on his way to call upon Harris. "I have just left him," said Tregent, "in a violent passion, having waited for you ever since one o'clock." "What have you been doing at the theatre?" said Sheridan. "Why," replied Tregent, "Harris is going to make Bate Dudley a present of a gold watch, and I have taken him half-a-dozen that he may choose one for that purpose." "Indeed!" said Sheridan. They wished each other "Good day," and parted. Sheridan proceeded to Harris's room, and when he addressed him it was evident that his want of punctuality had produced the effect which Tregent had described. "Well, sir," said Harris, "I have waited at least two hours for you again. I had almost given you up, and if—" "Stop, my dear Harris," said Sheridan, interrupting him, "I assure you these things occur more from my misfortunes than my fault. I declare I thought it was but one o'clock, for it so happens that I have no watch, and, to tell you the truth, am too poor to buy one; but when the day comes that I can, you will see I shall be as punctual as any other man." "Well, then," said the unsuspecting Harris, "if that be all, you shall not long want a watch, for here (opening his drawer) are half-a-dozen of Tregent's best; choose any one you like, and do me the favour of accepting it." Sheridan affected the greatest surprise at the appearance of the watches, but did as he was bid, and selected certainly not the worst for his present.

When Washington's secretary excused himself for the lateness of his attendance, and laid the blame upon his watch, his master quietly said, "Then you must get another watch, or I another secretary."

The following original anecdote has been communicated to Mr. E. J. Wood by Mr. John Bullock, of Sevenoaks:—A gentleman, who now fills a responsible situation in one of the national exhibitions, some years since became bail for a friend, and went before the then Lord Mayor of London to justify, when this conversation took place:—

Lord Mayor.—What is your name?

Bail.—W— F—.

Lord Mayor.—Well, Mr. F—, you have come here to be bail for your friend; what are you?

Bail.—An articulator, my lord (an articulator is one who puts in correct order the bones or skeletons of animals).

Lord Mayor's Clerk.—What is that?

Lord Mayor.—Oh! I know, you have to do with clocks and watches.

The bail, being unwilling to expose my lord, bowed assent, and so the chief magistrate of the City passed for wise, and matters went off satisfactorily.

Dr. Bigsby says that an old friend of his, a Nottinghamshire clergyman, being in London, went one evening to the pit of Drury Lane Theatre, to see some famous actor of the day—Kemble or Kean. There was a great rush for admission at the entrance, and, while sorely pressed by the crowd, he felt somebody's hand busy with his watch-pocket. Searching to see if his watch was safe, he found that his fob was empty, whereupon, remarking a suspicious-looking fellow immediately in advance of him, he promptly charged him, but in a whisper only, with the robbery. "You've got my watch," said he. At the next moment a watch was slipped into his hand by the party addressed, with the words, "Say nothing about it; here it is." The clergyman conveyed the article to a more secure place of deposit, and thought little more of the matter until his arrival at his inn, after the close of the performance. On going up to his bedroom at the "Bull and Mouth," the first object he saw was the black ribbon with the seals appendant, of his own watch, hanging at the bed's head; and on examining his coat pocket, he found a most magnificent watch, of the value of some £40 or £50, that had doubtless been stolen a short time before it had been handed to himself by the thief in question. He repeatedly advertised the watch in the newspapers, but it was never claimed; and he used afterwards to exhibit it to his friends, and tell its story to them, with a comic expression of satisfaction, at the idea of having fleeced an Arab of his spoil in so unconscious a manner.

Apropos of watch stealing, we are reminded of a silver hunting watch that belonged to one of the whippers-in of Lord Middleton's fox-hounds in Nottinghamshire. It had the words "Jack Stevens" on its face instead of the usual figures, the letters representing eleven figures, and in lieu of the twelfth figure was a fox's head. Such an arrangement might, in many instances, serve a watch from being stolen.

The following story is told of a poor watchmaker's trick to obtain employment:—He settled at a populous country town where he was unknown, and had no trade. He contrived when the church door was opened daily, to send up his son to the church-tower unseen, to alter the clock. This the lad was enabled to do, and as every one swore by the church clock, all the watches in the neighbourhood were repeatedly found to be wrong, consequently the owners of them sent them to the new comer to be repaired and set right. By the way, we may add a few particulars relating to watch-papers as they were called, but which were as often of silk, velvet, and muslin, printed or worked with the needle, as of the material whence they derive their name. These papers were used in the outer cases of the large old fashioned watches, before the introduction of the present compact form of such instruments, and were decorated with verses or devices, as tokens of love or friendship. The papers were frequently very neatly cut with elaborate designs, sometimes spreading over the whole field, while at others a circle or oval was left in the centre, on which a miniature was painted. In an old silver watch were these printed lines:—

"Time is—the present moment well employ,
Time was—is past—thou canst not it enjoy;
Time future—is not, and may never be,
Time present—is the only time for thee."

We find the following "Lines on a Watch-paper," in the *Gentleman's Magazine* for May, 1797, with the initials M.E.L.:—

"Life's morning hours unthought of fly,
Without watch;
Life's noontide hours neglected die,
By deaf watch;
Life's eve's repentance makes us cry,
For stop watch;
Life's midnight hour then beats by sigh,
A death watch."

A watchmaker named Adams, who practised his craft early in this century at Church-street, Hackney, was fond of putting scraps of poetry in the outer cases of watches sent to him for repair, one of his effusions was as follows:—

"To-morrow! yes, to-morrow! you'll repent
A train of years in vice and folly spent.
To-morrow comes—no penitential sorrow
Appears therein, for still it is to-morrow.
At length to-morrow such a habit gains,
That you'll forget the time that heaven ordains;
And you'll believe that day too soon will be,
When more to-morrows you're denied to see."

Two watch-papers, executed at the commencement of the reign of George III., the one of white cambric wrought in gold thread with the letters G.M.C., within a double circle of loop chain work, and the other of white muslin, with the initials S. G. in brown hair, are still preserved. Printed watch-papers with the head of William, Duke of Cumberland, were published in 1746, and some of white and pink satin, with the portrait of Queen Caroline, were common about the year 1821. Perhaps the most famous watch-papers were those printed on the ice during the frost fair of 1814.

It seems that watchstands came into use about the middle of the seventeenth century, but their history is very uncertain. One of that date is still preserved, it is of carved oak, eight inches high, and in design much resembles some of the mural monuments of the period. Two scrolls form a sort of pediment above, with an escalopshell in front. It has side columns with four large flowers surrounding the circular opening for the face of the watch, and the lower part is pointed. At the back is a curved channel to contain the chain, which, when placed in the stand together with the watch was shut in with a sliding backboard. Immediately behind the shell is a round hole to admit a hook or nail, by which the stand was suspended against the wall. There is also extant another watch-stand of carved wood, nine inches and three quarters high, of German workmanship of the time of Francis I., 1741-1765. It represents the two-headed eagle, the imperial crown being placed between the necks, a branch of laurel proceeds from the crown and falls on each side of the circular opening in the breast of the bird. The sockets of the wings are still visible, but the wings themselves are gone. The bird stands upon a base of three stages, and the whole is painted in various colours. Some of the old watchstands represented Time, from whose finger the watch depended; others were in the shape of horses, camels, and elephants, with panniers, vases, and temples on their backs; and others of a more common description were in the shape of churches and castles, with the watch face appearing in the turret and over the gateway. During the last century ladies exercised their ingenuity in making watch-stands of rockwork formed of bits of spa, galena, and coloured glass, garnished with green moss, or of shells and seaweeds, or of cardboard besprinkled with glittering frostings, and decorated with cut, folded, and twisted paper, and gold and silver foil and spangles.

Curious Announcement of the Death of a Jeweller.—The following is said to have been extracted from a Spanish paper, though we cannot vouch for its authenticity: "This morning, our Saviour summoned away the jeweller, Scebald Illmaga, from his shop to another and better world. The undersigned, his widow, will weep upon his tomb, as will also his two daughters, Hilda and Emma, the former of whom is married, and the latter is open to an offer. The funeral will take place to-morrow.—His disconsolate widow, Vesonique Illmaga. P.S.—This bereavement will not interrupt our business, which will be carried on as usual, only our place of business will be removed from No. 3, Tessi des Teesituriers, to No. 4, Rue de la Missionnaire, as our grasping landlord has raised our rent."

Mode of Protecting Silver Work.—The loss of silver from the sulphur in our atmosphere, especially where gas is used, and its consequent cleaning, is of some moment. A German silversmith, some years ago, tried the experiment of covering his goods with a thin solution of collodion, which he stated to have answered perfectly well, he having no more loss of metal, and no longer the constant labour in keeping his articles clean. The plan adopted is as follows:—He first warms the articles to be coated, and then pays them over carefully with a thinish collodion diluted with alcohol, using a white soft brush for that purpose. He says it is generally advisable to do them over more than once. Silver goods, he states, have been exposed in his window more than a year, and were as bright as ever, while others, unprotected, became perfectly black in a few months.

Last year the total number of British coins struck at the Royal Mint, as appears by the report recently issued, was 30,036,410, and the amount £5,007,142 6s. 3d., consisting of £4,711,459 10s. in sovereigns and half sovereigns, £234,232 2s. 11d. in silver, and £61,450 13s. 4d. in bronze. The figures include the bronze executed by contract.

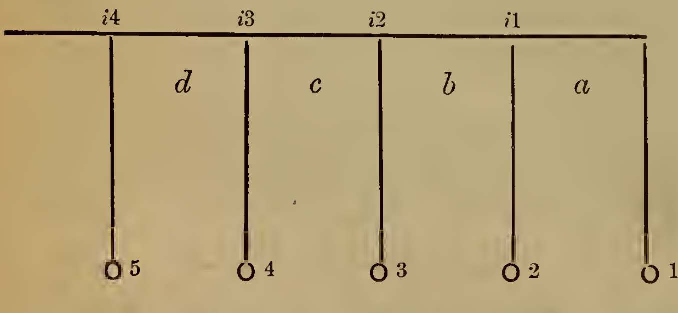
Prices Current for Gold and Silver—Value Given for Old Gold and Silver by Assay. Fine Gold, 84s. per oz. Fine Silver, 4s. 8d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3 d. per oz. Fine Silver, 5s. 3d. per oz. Standard Silver, 4s. 8d. to 4s. 10d. (variable.)

TELEGRAPHIC TRANSMISSION OF THE ASTRONOMICAL TIME IN GENEVA.

MONS. LOSSIER gives the following description of the above in our Swiss contemporary: "It seems that the want of correct transmission of the astronomical time had been felt for a long time in Geneva, especially among the watch-manufacturing fraternity; and in 1873 a number of watch manufacturers formed themselves into a committee for the purpose of accomplishing this object. They met, however, with various difficulties, so that the project, as a private undertaking, had to be abandoned and transferred to the city authorities. The latter appointed a competent gentleman to make a report on the matter, and, on his recommendation, the system now in operation (since August, 1876) was adopted by the City Council in December, 1875.

"The clocks are divided into eight lines, all starting from the Town Hall, where the regulators and accessory apparatuses are deposited. The electrical current leaves these apparatuses and traverses the eight lines of clocks successively once a minute, so that the mechanism of the clocks is only once a minute under the influence of electricity, and each time the minute hand jumps a division. The electrical currents are alternate, *i.e.*, the current passes each minute in a contrary direction of the one of the proceeding or following minute. The clocks themselves are polarized electro-magnets. This is the only system which has as yet given satisfactory results, and Mr. Hipp, of Neuchâtel, the manufacturer of the telegraphic apparatuses, has, by the application of his latest improvements, succeeded in giving its functions a perfect regularity. The advantages claimed for this system are: the great facility with which the mechanism works, even with a feeble current; the small number of movable pieces; the absence of every spring subject to variations by atmospherical influences or molecular changes of the metal itself; the insensibility of exterior shocks and of the atmosphere on the electrical currents. The distribution of electricity in the apparatuses which have to be moved may be effected in two different ways—by *Serie* or *Cascade*, or by *Derivation*. To make this more comprehensible, let us compare it with a distribution of water, which is obtained in almost the same manner. A conduit constructed to supply water to a certain number of reservoirs, will, first run into the first, when that is once full, into the second, and so on. This is the distribution by Serie or Cascade. In the Derivation system, the water pipe reaches to the last reservoir, and each intermediary one receives the quantity of water destined to it by a special branch pipe. The same methods are applicable for imparting electricity to clocks, so that each apparatus is either traversed in succession by the whole current, or supplied separately by branches connected with the main wire. It is the last mentioned system which Mr. Hipp has adopted in Geneva as offering the greatest security, having the great advantage of rendering the clocks independent of each other, and any interruption occurring in one would have no influence on the movements of the others. To secure a correct working it is, however, necessary to calculate with exactitude the resistance which each clock opposes to the passage of the current, and to modify this resistance so as to make it equal everywhere. Let us suppose a line of a certain number of clocks, which we shall designate by 1, 2, 3, etc., commencing with the most distant from the regulator.



"The resistances of the branch lines between the different clocks are a, b, c, d. Let us see what supplementary resistance each clock requires.

"Clock 1 will require none.

"Clock 2, to obtain the same force of current as 1, it is necessary that from bifurcation i. the current meet with the same resistance from both sides. The supplementary resistance of clock 2 would therefore be equal to q.

"Clock 3.—As the current ought to be equal to 1 or 2, and consequently the half of both, the resistance, according to the laws of Ohm, ought to be the double of the total resistance from the bifurcation $i2$. The latter is $b+\frac{a}{2}$, so that the additional resistance of clock 3 would be $R^3=2\,b+a$.

"For clock 4 the calculation is the same. The current acting on this clock should be equal to the three preceding ones, and therefore also like the third of the total current traversing the line from bifurcation $i3$; so that the supplementary resistance R^4 should be three times stronger than the total resistance of the line from $i3$.

"The calculation of the latter would be:

$$r=c+\frac{(2b+a)\left(b+\frac{a}{2}\right)}{(2b+a)+\left(b+\frac{a}{2}\right)}$$

$$=c+\frac{2b^2+2ab+\frac{a^2}{2}}{3b+a+\frac{a}{2}}=c+\frac{(2b+a)^2}{6b+3a}$$

$$\text{or, } r=c+\frac{2b+a}{3}$$

"The supplementary resistance of clock 4 having to be three times stronger is therefore

$$R_4=3c+2b+a$$

"This calculation of resistances cannot be made once for all; it depends upon the number of clocks on the same line, the length of the latter, &c., factors which constantly vary, and require a consection of the resistances. But though this task is rather tedious, it is amply compensated for by the incontestable advantages of this system of distribution.

"Any regulator will of course not do to effect the contacts and to transmit the time. The contact, to make sure of it, must take place with a certain force, necessarily causing considerable friction; which could not be suffered by a regulator without altering its movement. Mr. Hipp has obviated this difficulty by a very ingenious arrangement. He separated the movement destined to effect the contacts from the one leading to the scape wheel, and during fifty-nine seconds these two movements are completely apart from each other. At the sixtieth, they act again upon each other by a small and very light poise, which occasions such a slight friction only as to be incapable of influencing the movement of the regulator. The escape movement consists of two wheels only, the escape wheel and the motive wheel. The latter has no fixed centre of rotation, but is suspended freely between two pinions, in which it catches. One of these pinions (1) is fixed on the same arbor as the escape wheel, and the other (2) is in communication with the arbor of the translator. The escape wheel is impelled by the weight of the motive wheel, which of course shifts and its axis descends. Arrived at the sixtieth second it unhooks a small poise, which in falling acts on a series of levers and lets go the detent of the minute movement. The latter then makes an evolution corresponding with the advance of a minute on the dial. The translator makes a half-turn, during which time the current passes successively into all the lines, and causes all the clocks to advance one minute. Simultaneously pinion (2), catching in the motive wheel of the escapement, makes a turn and lifts it back the exact distance which it descends every minute; and lastly, the poise and levers are returned to their proper places, ready for action for the next minute. The minute mechanism is set in motion by a weight of 40 kilos, and to regulate its movement, it was originally provided with a fly wheel, but this contrivance, although operating very well in other localities where precision to fractions of seconds is not required, was found to be insufficient for Geneva. An evolution of the commutator occupied sometimes fourteen seconds, sometimes fourteen and half, or again less; and the result was that all the precautions taken for securing exactitude in the transmission of the currents become illusory. After several unsuccessful attempts Mr. Hipp replaced the fly-wheel by a conical pendulum, which gave quite unexpected results. In fact, resistances introduced in the shape of friction or weights taken from or added to the motive weight, caused such minute variations in the speed of the movement, that the problem could be considered as solved. The speed was measured by means of a *coincidence clock*, which we shall describe presently.

"The regulator in its present form secures a most perfect precision, its mean daily variation being within the imposed limits of a tenth of a second. By the side of the principal regulator is an auxiliary one, constructed on the same principle as the former, but on an older and less perfect model. Both apparatuses are always acting, but one only, the principal one, transmits the current to the sympathetic clocks. If, for some reason or other, the principal regulator should have to be stopped, its communications can be transferred to the auxiliary one by simply changing the pins at the commutator, a change which can be effected in a few seconds. The auxiliary regulator would, in this case, have sole charge of leading the clocks till the principle one could resume its functions. The transposition from one regulator to another would cause a certain inexactitude in the time given as the two apparatuses, although synchronal in their movements, do not distribute the current to the lines in strictly the same time. This defect is, however, of little importance, as the occasions requiring a change of regulator are only exceptional.

"Comparisons with the meantime and the setting to it are very delicate operations, and when we state that sixtieth of seconds have to be dealt with, we need not mention that they demand the greatest care. To effect this, the Town Hall is connected with the Observatory by a telegraph wire. The apparatuses in use are :—

"*At the Observatory.*—A regulator specially reserved for the service of the astronomical time, and provided with a movable contact which can be set in motion or checked at will. In the first case, a small pin fixed on the escape wheel comes slightly in contact with a blade of platinum at the sixtieth second of each minute, and sends a current which is the signal of the time. This signal repeats itself every minute till the contact is set at rest and is received at the Town Hall by means of a 'coincidence clock.' The latter consists of a clock movement without the hour hand, which would be useless here, and is so regulated that the second is a sixtieth shorter than the normal second, *i.e.*, beats 61 seconds per minute. This disposition rests on the same principle as the vernier in the measuring of lengths, and its object is likewise to estimate with exactitude the fractions of units, which are here the fractions of seconds. The pendulum when at rest is hooked to the armour of an electro-magnet, in which the current coming from the Observatory acts; therefore, as soon as the signal of the sixtieth second arrives from there, the pendulum is unhooked and begins to beat. The seconds are then counted to the moment when the beating of the pendulum coincides with that of the regulator, and the figure so obtained gives the difference in the movement of the latter in sixtieth of seconds. We shall give one instance to make this more comprehensible. Let us suppose that the regulator has been found to advance a fraction of a second. The knob of the commutator is placed on the contact, so that the current arriving from the observatory acts on the pendulum, and the end of the current minute is then waited for. As we have supposed the regulator to advance, the pendulum will be unhooked a little after the former will have struck the last second; but as the 'coincidence apparatus' beats a second quicker by a sixtieth, it will approach the regulator's movement every second by a sixtieth, and will come up to it at the end of a number of seconds equal to the number of sixtieths it previously advanced. The exact moment of coincidence indicates, therefore, the precise variation in sixtieth of seconds; so if it takes place at the sixteenth second, for instance, the regulator advanced 16-60ths. If on the contrary, the regulator retards, the variation will be obtained by counting the number of seconds which the pendulum has yet to run from the moment of coincidence till the end of the minute. Supposing that moment to be again at the sixteenth second, the regulator would then retard 60 — 16 or 44-60ths. To make these observations properly, it will require a little practice, but that once gained they will be of the strictest exactitude. Two auxiliary pendulums effect the correction, each of their oscillations causes the regulator to gain or to lose one-sixtieth of a second, and the corresponding auxiliary pendulum is made to play as many seconds as there are sixtieths of variation. The Observatory and the Town Hall are provided with telegraphic apparatuses for the purpose of correspondence.

"The regulating is effected in the following manner:—At noon the astronomer observes the variation of the Observatory clock, and corrects it by loading the pendulum with additional weight. At one o'clock the *regleur* at the Town Hall communicates and asks the time, to which the astronomer answers if he is ready. In that case he sets the contact of his regulator in motion, and the signal will give itself automatically every minute for ten minutes, a sufficient time to allow the regleur to make his correction and to control the exactitude of movement. Should he notice an abnormal variation indicating some error or irregularity, he informs the astronomer of the fact, who then verifies his observations so as to modify the results if necessary. As a control for the proper working of the eight different lines, the office at the Town Hall is provided with a clock for each; the one for the last section is supplemented by a "coincidence clock," similar to the one already described, for the purpose of ascertaining precisely the variation of this last line with the actual time, and the time occupied by the translator in accomplishing an evolution. The movement of the latter, can by these means be watched daily, and corrected if it should vary from some cause or other."

QUERIES AND REPLIES.

S. R. S. says :—"I have some dentists' peblet gold. I alloyed it with brass and silver. I melted it several times, but it was so very brittle that I could not work it. I then added a $2½ gold coin, and fused all together, but it was as brittle as before. I then fused it, and dropped in lumps of pure saltpetre, but it is still as brittle as before. I fused the gold in a lump of charcoal with an alcohol blowpipe. Please tell me how to work it."

A.—You fail to state the proportions of your alloy. There may be an excess of zinc and copper, or the fusing may not have been complete. Place it, together with several small pieces of rosin and a little borax or carbonate of soda, in a small blacklead crucible, and heat to very bright redness with a good fire. If this does not obviate the difficulty, fuse the alloy with about three times its weight of nitrate of potassa (saltpetre), and treat the mass when cold with dilute sulphuric acid. Pour off the acid solution and fuse the alloy, together with any silver sulphate adhering to it and a little carbonate of soda. Any silver contained in the acid solution may be recovered by adding a little salt or muriatic acid, and fusing the precipitated chloride of silver with carbonate of soda.

H. M. S. asks :—1. "Of what is the bronze preparation made, and how is it applied to clock fronts?" *A.*—Bronze powders are made of various metallic alloys. The gold bronze is usually made of Dutch gold (an alloy of copper and zinc), and of the bisulphide of tin (aurum musivum). They are usually applied to metal work by means of an oil size or japan varnish. 2. "In what way can I remove the old bronze?" *A.*—Wash first with a solution of washing soda (hot), clean, and dry, and then rub with a little benzole, alcohol, or ether.

J. A. W. says :—"Having occasion to do some copper plating some time ago, I dissolved sulphate of copper in water in a glass jar. I then poured it off into my battery, and there was some left in the jar. I threw a small piece of iron into it, and left it for some days. I then took it out, and to my surprise, I found that it had been perfectly plated with copper. Please let me know the cause?"

A.—The reaction you note is taken advantage of to cheaply copper-plate small articles of cast iron. In the presence of water the reaction is as follows :—

$$\underset{\text{Sulphate of copper.}}{CuSO_4} + \underset{\text{Iron.}}{Fe} = \underset{\text{Sulphate of iron.}}{FeSO_4} + \underset{\text{Copper.}}{Cu.}$$

As the iron is a more positive metal than copper, it displaces the latter in combination with acids, the remaining positions of the iron becoming coated with the precipitated copper.

E. M. L. asks :—"How can I utilize small scraps of tortoiseshell?"

A.—Small pieces of good tortoiseshell may be joined so as to form one large apparently seamless piece in the following manner :—Slope off the margins of the shells for a distance of about a quarter of an inch from the edge. Then place them so that the margins overlap one another; and thus arranged put them in an iron press, and immerse in boiling water for some time. The pieces by this means become so perfectly united that the joint cannot be seen. The filings and very small scraps may be softened in hot water and consolidated by hydraulic pressure in metal moulds. Protracted heating of tortoiseshell darkens it, and greatly lessens its beauty.

M.A. asks :—"We have a lot of plated spoons that are discoloured with a bluish purple cast, resembling that on tempered steel. We fear to injure the polish. Can you tell us how to clean or remove the colour without injuring the polish?"

A.—The discolouration is very probably due to the formation of a film of sulphide of silver. This may be removed by dipping for a moment in strong nitrate acid, then washing immediately in running water. If the silver is permitted to remain in contact with the acid for more than a moment or two, the polished surface will be injured, so that it is preferable to rub off the film with a little finest tripoli powder and a piece of chamois skin or a soft brush.

A. G. asks, "Is the silver, for a reflecting telescope, put on the back of the glass the same as on looking glasses?"

A.—No. Only one side of the glass is ground and polished to the shape required. The silvering is done on this side; and then, with the softest buckskin and the finest rouge, the surface of the silver is polished for the reflecting surface. In cities where gas is used it will not retain its brilliancy very long, then it requires to be cleaned with nitric acid and re-silvered, which is only the work of a few hours when a person has become accustomed to it.

H. D. S. asks : "Will a solution of chloride of zinc and sulphate of nickel, used for nickel plating iron and steel, serve for nickel plating brass or zinc."

A.—Not very well, unless the article is in contact with pieces of zinc, or what is better, zinc powder, also immersed in the solution. Small pieces of brass-work can be plated in this way.

TABLE FORKS.

FREQUENT remarks are heard, expressing surprise that many of the discoveries and appliances which now minister to our daily wants and comforts should so long have remained unknown or inoperative—that such advantages as those we now possess, in the various applications of steam power, of gas, of electricity, of photography, of time-saving lucifer matches, and of numerous other benefits, "prompt and ready at our call," should not, long before the present century, have excited the attention and practical working of men of past generations. Though when we reflect that all the above-named discoveries, more or less, depended on scientific deductions, and that science in times past may be considered but as in its infancy, we shall in a great measure, cease to wonder at the delay which has preceded their present development. But their are articles, comparatively trivial in themselves, which now are so absolutely indispensable, from the palace to the humble cottage, that we can hardly conceive how they did not of themselves enforce the necessity of their manufacture. Of one of these now indispensable necessities, it is our purpose to speak, and we trust our remarks will interest, not merely the trade specially represented in this journal, but also a varied number of our subscribers.

The subject then of these remarks, as the heading of this implies, is "Table Forks," and little as the subject may seem to promise, we think it will be found amusing and instructive.

To begin with the beginning. The word "fork" comes to us from the French, *fourchette*, that word itself being derived from *fourche*, the original meaning deduced from a Greek, or as some say, from a Sanscrit word, signifying to carry, whence it is pleasantly said, the fork, so to say, is a third arm, which a man joins to the end of his other.

Our subject is limited, we need not say, to that useful instrument, the domestic fork, which, in accordance with its derivation, we use to lay hold of pieces of food, and to carry them to the mouth, or to arrange joints for carving.

A French author, M. de Laborde, thus expresses himself. "When I consider Pericles, Alcibiades, and the most delicate of the most refined times of Greece, eating with their fingers (after having washed their hands it is true), as was also done in the middle ages, and knowing only of the spoon to aid them at meals; when, in the polished age of Augustus, at the epoch of all the refinements of luxury, of the poetry of Ovid, of Martial, and of other poets of goodly breeding, it is without doubt that in Rome people ate with their fingers. When I read in Plutarch the rules of politeness and proper comportment to be observed, while so doing, I think to myself that the regulations of propriety are but conventional, and that the use of one's fingers in eating is only 'bad form,' since the introduction of forks; and that to judge civilization by the use or neglect of this utensil at table, is to form an erroneous judgment." Howsoever philosophically M. de Laborde may argue, we cannot but admit that to associate Sappho, or Horace's Lesbia, with her hands in a dish of black puddings (a favourite dish of the ancients), is something repugnant to our present ideas. Yet such things were for certainty, if the Romans had possessed any of these useful appendages to the dinner table, some would have been found with the many other specimens of domestic utility in the ruins of Herculaneum and Pompeii.

Ovid thus advises, in reference to the custom of eating with the fingers:

"Your meat genteely with your fingers raise;
And as in eating there's a certain grace,
Beware with greasy hands lest you besmear your face."

Our own poet Chaucer thus describes Madame Eglantine, the exemplary Prioress:—

"At mete was she wele ytaught withalle;
She lette no morsel from her lippés falle,
Ne wette hire fingeres with her sauce depe.
Wel could she carie a morsel, and wel kepe,
That no drope ne fell upon hire brest.
In curtesie was sette full moche hire lest.
Hire over-lippe wiped she so clean,
That in her cuppe was no ferthing sene
Of grese, when she drunken hadde hire draught,
Ful seemly ofter hire mete she raught."

So long then as she did not plunge her hand deep in the gravy, the poet admitted her right to thrust her "sop" in the pan, even though she greased the tips of her fingers in doing so.

In the book of Kerrynge, (1351), we are told, "Set never on fyshe, flesche, ne fowle, more than two fingers and a thombe."

To show further how much the introduction of this simple utensil has led to the advancement of the courtesies of society, and indeed how much our manufacturers of forks contribute to the decencies and comforts of life since their introduction, we will mention a few rules from various books of Courtesie, compiled for ladies and gentlemen of past ages.

The first from "Fiftié Courtesies for the Table," compiled by Fra Bonvisino Da Riva, about 1290, and rendered from the old Italian by M. A. Rosette.

"Dining with others by invitation,
Put not back thy knife into the sheath before the time;
Deposit not thy knife ere thy companion;
Perhaps also something else is coming to table which thou dost not reckon for."

By this prudent counsel, and by other passages, we assume that each person brought his own knife to the repast, and we also ascertain that one spoon only was used by a guest, whether for "fish, fowl, or good red herring."

Three centuries after we find in another Italian MS., by Giovanni della case, inter alia, the following advice:—

"You must not soil your fingers, so as to make the napkin nasty in wiping them; neither clean them on the bread, which you are going to eat." "I rather think not," adds Mr. Rosette. An old German, who writes under the designation of the Tanhaüser, has concocted some rules for courtly breeding, but most of which will scarcely bear quoting at the present time. One of the mildest I subjoin: "You are not to clean your teeth with knives as some do, and as still happens, here and there. He who does so, it is not good. He who likes to eat with spoons, and cannot manage to lift the food with them, let him forbear from the dirty way of shoving it on them with his fingers."

Without burdening this article with quotations, we will merely give one more, wherein the perils consequent upon the custom of eating with one's fingers are humorously detailed by Alexander Barclay, in the "Cytezan and the Uplondyshman." The former is describing a feast at Court at the beginning of the sixteenth century.

"A speciall custome is used them amonge,
No good dish to suffer on borde to be longe;
If the dish be pleasaunt, either fleshe or fishe,
Ten hands at once swarme in the dishe;
And if it be fleshe, ten knives shalt thou see
Mangling the fleshe, and in the platter flee.
To put there thy handes is perill without fayle,
Without a gauntlet or else a glove of mayle.
Among all these knives, thou one of both must have,
Or else it is harde thy fingers whole to save.
Oft in such dishes in Court it is seene
Some leave their fingers, each knife is so keene;
On a finger gnaweth some hungry glutton,
Supposing it is a piece of beefe or mutton."

Making some allowance for the humorous exaggeration of the above, it is certain that although in a few instances, hereafter to be referred to, forks are stated to have existed, they were rather considered as toys or "curiosities" than as articles for general use. Thus we find that Queen Elizabeth had, at the least, three forks: "one of crystal, garnished with gold and sparks of garnet; another of coral, slightly garnished with gold; and a third, of gold, garnished with two little rubies, two little pearls pendant, and a little coral." We find that this royal lady was always ready to make her courtiers "fork out" on every presentable occasion. Thus we see that in 1595, she dined at the house of Sir John Pickering, who presented her with a rich fan, the handle of which was set with diamonds; an artificial nosegay composed of jewels, and "*to grace him still the more*, she of herself tooke from him a salt, a spoone, and a forcke of fair agatte."

It is evident that these jewelled articles were more for ornament than utility, for even to the last we find this virgin-virago, when eating in public or in private, fingering her victuals, and it would scarcely have appeared probable to her, that before another century should have passed, no lady could have done so without raising disgust in the eyes of all who might behold her grossness and breach of common decorum. And what a thrill of horror now runs through polished Belgravia, or the dinner-tables of aristocratic Tyburnia, when some Continental importation, ignorant of our rules of good breeding, begins eating peas with his knife, or any similar grossièreté. And yet it is scarcely two centuries back when far more palpable inroads on decent behaviour must have passed without comment in general society. It may amuse our readers to read the annexed extract from "The Lady's Rich Closet of Rarities," published in London, 1653.

"A gentlewoman, being at table, abroad or at home, must observe to keep her bodie straighte, and lean not by any means upon her elbowes, nor by ravenous gesture discover a voracious appetite. Talke not when you have meate in your mouthe, and do not smacke like a pig, nor eat spoonmeat so hot that the tears stand in your eyes. It is very uncourtly to drink so large a draught that your breath is almost gone, and you are forced to blow strongly to recover your speech. Throwing down your liquor, as into a funnel, is an action fitter for a juggler than a gentlewoman. In carving at your own table, distribute the best pieces first, and it will appear very decent and comely to use a fork—so touche no piece of meate without it."

It was necessary that some directions should be given for the use of the fork now becoming general; for hitherto, meat, fish, and all solid food was eaten with the fingers, and society had dictated many rules how to use them with delicacy.

The remarkable silence of Shakspere, respecting the use of silver forks, has been noticed by the late Walter Thornbury. This was the more strange as the use of forks was a new custom recently then introduced from Italy, and was the subject of constant discussion, praise, and ridicule. Mr. Thornbury observes, "Is it not remarkable that Shakspere, who makes Mercutio talk all the slang of the fencing schools, and Don Armado quibble with all the fantastic pedantry of Lilly, should have overlooked the strange new custom imported from Italy? How well it would have come into the scene, where Mistress Anne Page invites Slender to dinner, or where Timon feasts his false friends." This is the more noticeable, as Shakspere's contemporaries more than once make mention of the utensil. Ben Jonson, in his comedy "The Devil is an Ass," observes, in answer to a question:—

> Meerc. Have I deserved this from you two for all my pains at Court to get you each a patent?
> Gill. A patent! For what?
> Meerc. Upon my project o' the forks.
> Gill. Forks, what be they?
> Meerc. The laudable use of forks. Brought into custom here as they are in Italy. To the sparing of napkins.

He also shows us that they were made of silver:

> "Then you must learn the use and handling of your silver forks at meals."
> —*Volpone or the Fox* (*Act IV. Sc.* 3.)

Beaumont and Fletcher, in the "Queen of Corinth" (*Act IV., Sc.* 1.), mention, "Your fork-carving traveler."

It is certainly remarkable, that this, now so needful an appendage at our tables, should for so long a period have remained unknown or unthought of, and have so long delayed its appearance. When we consider how many of our manufacturers now devote their energies to the production of this article, either in the precious metals, or their numerous substitutes, it is really surprising that no *bon vivant* of former days never thought of a table-fork; and especially as forks for culinary purposes must have existed from very early times, as we find in the 1. Samuel ii. 13-14, where the "Flesh-hook of three teeth" was spoken of, meaning, as we should say, a three-pronged fork. So, too, the Greeks and the Romans, as well as other ancient nations, must have had several kinds of pronged utensils for withdrawing meat from the pots or cauldrons.

Particularly is this deficiency noticeable, since from the recumbent position of the ancients at their meals, forks would certainly have been more useful to them than even to us in modern times who have the free use of both of our hands. Indeed, in consequence of this deficiency, it was requisite that meats should be cut into small pieces in Greece or Rome, before they were placed before these gastronomics. And certainly if any nation might have had an inducement to anticipate the invention of forks, it would have been the luxurious Romans, who at their feasts plunged their hands into such complicated and disgusting messes than which nothing can be conceived more disgusting and abhorrent.

Above all things, pork was most acceptable at their meals, and it is recorded that they knew how to give it eighty different flavours. Indeed, the variety of porcine plâts, of which the composition has been handed down to us, is almost endless. Fancy Ovid's Julia, *par exemple*, plunging her delicate fingers into what was a special favourite dish at their Symposium; or Glaucus and Ione, the *crême de la crême* of Pompeii, manipulating, what shall we say, a pork haggis, for the Apician pork haggis was esteemed above all other dishes. It was a boiled pig's stomach, filled with fry and brain, raw eggs and pine apple, all beaten to a pulp, and treated with the never absent seasonings and sauces. Of the sauces, it may be observed, *en passant*, the most prized was the "garum," the chief ingredient of which was a putrid distillation of stinking fish.

The origin and primary use of this utensil as a domestic necessity are somewhat obscure. Archælogists record occasional discoveries of rude articles of this description, probably of Anglo-Saxon workmanship, but evidently not intended for feeding purposes. Some of the earliest records of the existence of forks in Europe are subjoined; but it will at once be seen that in these instances they were rather ornamental than useful. In the wardrobe account of Edward I. (1300) we find mentioned: "Unum par cultellorum, cum manicis argento aymellat; cum uno forchetto de crystallo, dat' per Dominam Mariam de Britann', Comitassam de Santo Paulo, apud Guadavam;" or, as we should say, "a pair of knives with sheath of silver enamelled, and a fork of crystal, the gift of," &c. It appears also that in 1313 Peers Gavestone, the unworthy favourite of Edward II., had sixty-seven silver spoons and only three forks, and, curiously enough, these are described as "*trois fourchettes d'argent pour mangiér poises*," and in one instance "*à prendre la soupe au vin.*"*

So also do we notice in the inventory of John, Duke of Brittany (1306) "ij petriz gameaux et une fourch d'argent à traire soupes."†

We find, too, in the "Comptes royaumes de France" of "*Une fourchette d'or, pour Madame la Duchesse D'Orleans, 'à prendre la soupe au vins.'*"

To show, however, the limited number of these articles, we observe that in 1328, the Queen Clemence of Hungary, had thirty spoons, and one gold fork. Queen Jane of Evreux left at her death one fork carefully preserved in a case, and sixty-four spoons. In 1389 the Duchess of Tuscany had nine dozen silver spoons, and only two forks, silver gilt. In the Kalendar of the Exchequer, temp. Henry IV. (1399), we find, "Item, un fourche de berill garnis d'or, pur vers gyngiore (for green ginger), garnis d'un balays; j'saphir, ij petites perles pris xx. s." So also in the inventory of the 15th century are several illusions to the fork, but not, as now-a-days, in conjunction with the knife. Many other examples may be cited, all of which show the paucity of this article, in what we call the middle ages. We will merely mention the splendid forks possessed by Charles V. of France, with the handles inlaid with precious stones; but to what purpose, think you, were these valuable curiosities devoted? To toasting cheese, which was eaten with sugar and powered cinnamon. It appears then that forks were not entirely unknown in a few instances, but certainly they were not employed for ordinary uses, and although society was then advancing with many conveniences of life, they still continued at a rarity, even among the highest ranks, while to the lower classes they were of course unknown. And even when their use became somewhat more general, the old adage, "Fingers were made before forks," was often applied by the vulgar, and will show the disdain and contempt with which they were rejected when in later times they were introduced from Italy. Just so the people of the East still adhere to the guidance of nature, and dive hand and fist into their greasy or succulent messes, as did their ancestors in days of yore. In Spain too, we are told, particularly in the country districts, the more original use of the digets is preferred to any other. It is certainly very amusing to notice the dexterity with which the Chinese, eschewing modern innovations, can with their chopsticks take up even a single grain of rice, or the smallest modicum of their canine ragout.

(*To be continued.*)

PRACTICAL INFORMATION FOR THE TRADE.

In the *Revue Chronométrique* Mon. Cadot gives the following method of smoothing and silvering pure Aluminium. He simply uses essence of turpentine and emery paper; first the coarse, which quickly smoothens the surface, then the finer (from one to three), and lastly, silver paper previously immersed in the essence, which gives it the finishing touch.

The *Tura Bernois* mentions a great simplification in watchmaking, said to be introduced by a Swiss named Renan. The barrel and wheel he replaces by a single great wheel to which a spring is adapted four times weaker than that of ordinary watches, but has nevertheless a tension three times stronger. The remontoir mechanism may be applied without difficulty to this movement; the disposition of the parts and the wheelwork allow the employment of either the anchor or cylinder escapement. It is stated that the adoption of this system would diminish the price of a watch by one-third. No doubt a fine invention if it only realizes half the expectations.

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* "Soupe au vin" does *not* mean wine-soup, but wine, with small pieces of bread or toast floating in it; "sops" in fact, as we find in "Taming of the Shrew."

> "——quaff'd of the muscadel,
> And threw the sops all in the sexton's face."—*Act III., Sc.* 2.

† "A traire soupes," signifies to draw out the sops.

NICKEL PLATING.

THE art of electro-plating with copper, silver, and gold was first practised about the year 1836, and shortly afterwards electro-metallurgists turned their attention to nickel, as a white metal susceptible of a high polish, and which does not become discoloured in ordinary use; but its deposition by electricity was found to present peculiar difficulties. One of these difficulties, as stated by Mr. James Napier, in his "Manual of Electro-Metallurgy," is in the following terms:—"The great difficulty experienced is to obtain a positive electrode. The metal is very difficult to fuse, and so brittle that we have never been able to obtain a plate or sheet of it. Could this difficulty be overcome, the application of nickel to the coating of the metals would be extensive, and the property of not being liable to tarnish would make it eminently useful for all general purposes." But another, and even greater difficulty was the preparation of the solution to be used in the deposition of the metal. In the year 1840, Joseph Shore obtained letters patent for depositing nickel out of a solution of nitrate of nickel, by means of the galvanic battery, on manufactured articles of certain metals and alloys of metals; and in 1854, Frederick Thomas, and William Tilley obtained a patent for plating, by means of the galvanic battery, upon other metals from a solution of nickel, prepared by dissolving nickel by muriatic acid, and precipitating the oxide by ferrecyanide of potassium, and then adding cyanide of potassium dissolved in distilled water. Mr. Remington, of Boston, obtained a patent in this country, in the year 1868, for "an improved process and means for electro-plating with nickel."

He thus describes the nature of his solution:—"I take refined nickel and dissolve it in nitric acid, slightly diluted with water, say about one-twentieth part of the latter, adding the liquid to the nickel by degrees until it is entirely dissolved. The nickel is then precipitated by the addition of a suitable quantity of carbonate of potash. The precipitate thus obtained is then thoroughly washed with pure water, after which it is dissolved in a strong solution of sal ammoniac, and filtered, when it will be ready for use." Messrs. Becquerel, the eminent French chemists, had effected an electro-deposition of nickel in their laboratory on some manufactured articles about the year 1865; and it may be added that several works, published previously to the year 1869, such as "Gore's Theory and Practice of Electro-Deposition;" *The Chemical News* of September 6th, 1862; "Smee's Elements of Electro-Metallurgy;" and "Gibbs' Contributions to Chemistry," speak of the electro-deposition of nickel; but none of them describe a solution or a process of any practical use in the art of electro-plating metals and metallic substances with nickel.

It is clear, therefore, that the mere electrolysis of nickel out of a salt of that metal was well known to chemists and metallurgists; but it is equally certain that the art of plating metals, or metallic substances, with nickel by electro-deposition, in such a manner as to secure a compact, smooth and tenacious surface, was not known previously to the year 1869. In that year, Dr. Adams, jun., of Boston, Massachusetts, in the United States of America, obtained letters patent in his country for his invention of "Improvements in the Electro-Deposition of Nickel," and in the following year he obtained another patent for "Improvements in Effecting the Electro-Deposition of Nickel." In his several specifications, Dr. Adams claims to have discovered practical processes by which all the difficulties in the way of the electro-deposition of nickel can be overcome, and also the manner of casting an anode, by means of which an uniform density of the solution can be maintained, and the metal continuously and uniformly deposited. He describes his several processes very minutely, and shows most convincingly that the electro-plating of metals with nickel had no practical existence before the date of his inventions. These patents have been assigned to the Plating Company (Limited), who, by fully developing the advantages of the processes invented by Dr. Adams, claim to have introduced nickel-plating to the people of this country as a practical and useful art.

It is well known that when any important discovery or improvement is offered to the public, there are not wanting persons who attempt to appropriate to themselves the results of experiments and researches possessed for many years, and no exception to the general rule has been made in favour of the Plating Company. No sooner had they (as the assignees of Dr. Adam's patents) established the business of electro-plating with nickel, than attempts were made to infringe their patent rights, and, in most cases, by persons either incompetent or without sufficient means to practice the art successfully, but who, by offering to do their work at prices below the ratio established by the Company, succeeded in diverting a portion of the business from the Company's establishments in London and Sheffield.

In 1874 the Company filed a Bill in Chancery against the Sheffield Nickel and Silver Plating Company, Limited, who, by their answer denied that they infringed the Plating Company's rights, and stated that they were working according to a process invented by one John Unwin, of Sheffield, and for which he had obtained Letters Patent, dated the 21st December, 1871. The Plating Company thereupon proceeded against Mr. Unwin by *scire facias.* The action was tried before Mr. Justice Blackburn and a special jury, and a verdict was found for the Crown, and on the 9th February, 1877, the seal was cut from Unwin's Letters Patent in the presence of the Lord Chancellor, and a *vacatur* entered in the Register of Patents. A decree, with costs, has since been made in the suit by the Master of the Rolls, restraining the defendant Company from using the Plating Company's processes. Mr. Unwin has had numerous imitators, but few of their alleged imitations have received more than provisional protection, and although many nickel solutions have been tried, none of them have been found to give satisfactory results.

The experience of seven years brings us to the conclusion that the art of electro-plating with nickel, as made accessible to the public by Dr. Adams's inventions, is applicable to many ornamental and useful purposes; and that, as a coating for brass, iron, steel, and copper it has no equal, so far as our present knowledge of metals extends.—*Iron.*

PRESERVING METALS.

FOR preserving metal and other substances from decay and fouling, Mr. Charles Weightman Harrison, of South Kensington, London, proposes to dissolve the crystalline hydro-carbon known as ozokerit in any of its solvents, such as benzole, petroleum, oil of turpentine, or resin oil, and he then mixes the solution in any desired proportion with other suitable bodies according to the purpose for which it is required. He mentions that his experiments have been made with ozokerit as a type of the mineral hydro-carbons, which are built up of molecules containing not less than 20 atoms of carbon, such minerals being capable of resisting the action of all acids at ordinary temperatures, and suffering no deterioration from atmospheric influences. On this account he has found them valuable for mixing with gums, resins, and colours applicable to a great variety of purposes for preserving, as they impart thereto a high degree of permanence. He explains that a simple and ready mode of preserving bright metals from rust is to rub them over occasionally with a wax formed by melting together equal parts, or nearly so, of ozokerit or beeswax. It is easily applied in a thin coat by rubbing the compound on the metal with a cloth. In applying this compound wax to iron, he sometimes adds finely powdered plumbago to give it the colour of the metal. Another compound or solution for preserving metals he forms by dissolving in a sand bath (say) 4 ozs. ozokerit and 4 ozs. marine glue in 2lbs. benzole, and then adds 4lbs. linseed oil and ½ lb. essence of turpentine. The mixture is kept gently boiling in the bath for an hour or so, after which it is ready for use, and may be applied to the metal by a soft brush, as in ordinary painting. In some cases he impregnates the surface of the metal deeply by forcing the compound of ozokerit into the pores by exhaustion or pressure, or the two combined. A convenient apparatus which he uses for this purpose, consists of a metal cylinder such as a wrought iron boiler of a suitable size and strength equal (say) to about 200 lbs. to the square inch, fitted by connections with exhaust and pressure pumps in a manner which is well known. This cylinder is provided with an air-tight door and a safety valve. When the metal articles have been placed in the cylinder, the air is exhausted to about 27 inches of mercury, and the hydro-carbon fluid is then admitted through a connecting pipe until the articles to be impregnated are covered. The pressure is then put on, and the fluid forced into the exhausted pores. He also claims painting or coating metals with a compound formed by melting together about 5 lbs. of ozokerit, 5 lbs. resin, and stirring the fluid in two gallons rectified spirit (65 degrees over proof), in which 2 lb. gum sandarach and 2 lb. garnet lac have been dissolved. Add turpentine varnish to them, and boil at a gentle heat for an hour or so. Filter through a fine cloth, and preserve for use. He forms a protecting varnish for suspended or open air telegraph wires by coating them with a fluid, formed by mixing together and heating at a low boiling point for a short time, ¼ lb. ozokerit, ¼ lb. gutta percha, or india rubber, 1 lb. rectified resin oil, and 2 lbs. linseed oil varnish. As varnish for outdoor ironwork he proposes to dissolve, in 2 lbs. tar oil, ¼ lb. ozokerit, and ½ lb. resin, mixed while hot in an open pot. The invention also includes a process of poisoning barnacles with strong tonic bitters—Angostura and the like—or weak strychnine.—*Scientific American.*

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Levenburg, Gustav, 2a, Vyse-street, Birmingham, jeweller's factor, June 28. J. Parr, sol., 27, Colmore Row, Birmingham.

Crundell, Walter John, Broad-street, Leominster, jeweller. June 29. C. B. Hodgson, 13, Waterloo-street, Birmingham.

Mercer, Joseph Barnes, Chapel-fields, Coventry, and 7, Warston-lane, Birmingham, watch manufacturer. June 29. O. Minster, sol., Coventry.

Holmes, Joseph, Penrith, jeweller. July 4. Burman & Crompton, sols., 41, Cherry-street, Birmingham.

Stead, James, 189, West Ferry-road, Millwall, jeweller and watchmaker. June 30. W. Archer, sol., 440, Commercial-road East.

Thomas, David, 44, Commercial-street, Aberdare, watchmaker and jeweller. July 3. H. P. Linton, sol., Aberdare.

Tuck, Edward, Charlotte-street and City Metal Works, Bath, metal worker. July 6. T. Wilton, sol., Bath.

Eginton John Lewis, Margate, watchmaker and jeweller. July 10.

Hodge John Surridge, 9½, Summer-lane, Birmingham, jet dealer, &c. July 11. Sargent & Son, sols., Argyle-chambers, Birmingham.

Leapman Priscilla, Hastings, dealer in jewellery, &c. July 9. Lamb, sol., Brighton.

Swindells John, 8, Lower Highgate, Stockport, jeweller. July 10. Addleshaw and Warburton, sols., 67, King-street.

Broadhead Edward Augustin, 4, Cleveland-street, Middlesborough, watchmaker. July 12. J. W. Teale, sol., Middlesborough.

Elliott John Catcheside, John Henry Elliott and Robert Thomas Elliott, trading as J. C. Elliott and Sons, 2, Leighton-street, Leeds, clock and watchmakers and electricians. July 11. T. Dalton, sol., Leeds.

Elliott John Catcheside, 2, Leighton-street, Leeds, clock and watchmaker and electrician (sep. crdtrs). July 11. At T. Dalton, sol., Leeds.

Elliott John Henry, 2, Leighton-street, Leeds, clock and watchmaker and electrician (sep. crdtrs). July 11. At T. Dalton, sol., Leeds.

Elliott Robert Thomas, 2, Leighton-street, Leeds, clock and watchmaker and electrician (sep. crdtrs). July 18. T. Dalton, sol., Leeds.

Hately Charles Jeffreys, trading as M. T. Hollands, 37, Benby-street, Birmingham, jewellers' chain manufacturer. July 19. A. Green, sol., Ann-street, Birmingham.

Hawkins Charles Lewis, 354, High-street, Cheltenham, watchmaker and jeweller. July 21. F. Stroud, sol., Cheltenham.

Hay John, trading as Hay and Son, 21, Wellington-street, Woolwich, watchmaker. July 17. G. Whale, sol., 3, Furnival's Inn, Holborn.

Marks Michael David, trading as M. D. Marks and Co., Vyse-street, Birmingham, jewellers' factor. July 16. C. B. Hodgson, sol., Waterloo-street, Birmingham.

Furneaux, Thomas Gorsuch, Coventry, watch tool and material dealer. July 25. At White Lion Hotel, Smithford-street, Coventry, August 9 at 3. G. Woodcock, sol. Coventry.

Stead, James, 139, West Ferry-road, Millwall, jeweller and watch and clock maker. July 24. At W. Archer's, sol. 440, Commercial-road, East, August 9 at 4.

Adjudications of Bankruptcy.

Atkinson, Thomas Weatherby, 76, Buccleuch-street, Barrow, and Dalton-in-Furness, jeweller. June 27.

Pearson, Edward Martin, & Henry Brown, 2, Praed-street, Edgware-road, jewellers, &c. June 26.

Hayward, James, Fore-street, Hertford, and High-street, Hoddesden, Herts, watchmaker and jeweller. June 30.

Ball, George James, trading as Brugger & Straub, 79, High Holborn, and 200, Brixton-road, late 71, Rosemary-road, Peckham, jeweller, July 24. At Bankruptcy Court,sLincoln's Inn-fields. August 14 at 11½.

Ward George, 130, Camberwell-road, clothier, jeweller, &c. July 26. At Bankruptcy Court, Lincoln's Inn-fields, August 8 at 1.

Dividends.

Haworth, William (Liq.), jeweller, Market-street, Blackburn. 1st and final div. 3s. 10½d.;—Marlow, 24, Cross-street, Manchester, sol.

Redgate, Edwin (Liq.), Sheffield and Nottingham, jeweller, &c. 1st div. 3s.;—E. Needham, 121, Norfolk-street, Sheffield.

Flower, Walter L. (Liq.), 73, Jermyn-street, and Fairlawn-villas, Merton, jeweller. 1st div. 1s. 9d.; R. Webb, 86, Newman-street, Oxford-street.

Trustees Appointed.

Berry, Arthur, trading as Berry & Co. (Bkt.), 45, Hatton-garden, and 25, Bloomsbury-square, jeweller. Tr., T. Wilkinson, 10, Swinton-street, manufacturing goldsmith.

Harrison, Francis (Liq.), Morpeth, Northumberland, watchmaker. Tr., T. Gillespie, Morpeth, accountant.

Lister, Thomas (Bkt.), Marlborough-hill, St. John's Wood. Tr., J. Pike. 138, New Bond-street, jeweller.

Martin, William (Liq.), High-street, Guildford, watchmaker. Tr., W. C. Harvey, 1, Gresham-buildings, Basinghall-street, London, accountant.

Thompson, Jacob B. (Bkt.), Wraysbury, Bucks, metallurgist. Tr., C. J. Lee, 8, Poultry-chambers, accountant.

Dissolutions of Partnerships.

Ball & Hopper, 12, Arlington-street, Clerkenwell, gold and silver chain manufacturers. May 18. Debts by Thomas B. Bell.

Cowen, M. & Co., Withey-grove, Manchester, jewellers and watch importers. June 5.

Jennings & Dickenson, 70, Hatton-garden, electro-plate manufacturers. June 18.

Distribution of Assets.

Westbeech, John L., 3, Queen's-terrace, Queen's-road, Dalston, watchmaker, died January 6, 1857. Claims by August 11, to R. B. Barrett, 2, John-street, Bedford-row, Sol.

Meetings.

Atkinson, Thomas W. (Bkt.), Barrow and Dalton, jeweller. At C. C. Ulveston, August 13 at 10, exam.

Hayward James (Bkt), Hertford and Hoddesdon, watchmaker. At C. C. Hertford, August 13 at 1, exam.

Last Days for Lodging Claims.

Long Joseph (Liq.) Regent-road, Salford, watchmaker. Claims by August 14 to H. G. Nicholson, 100, King-street, Manchester, accountant.

Scotch Sequestrations.

Meek, John, 29, Buchanan-street, Glasgow, dealer in clocks and silver plate. July 30, with protection. Tr., and Com., Faculty Hall, Glasgow, August 10 at 12. Claims by November 30. Agents, R. & T. Sinclair, 12, Miller-street, Glasgow.

THE SILVER QUESTION.

TWENTY-THREE countries or states of the world have placed their views on the subject of silver before Her Majesty's Government. They range from the Netherlands to Japan, and include that which it may surprise a few cosmopolitans to hear is still styled "The Latin Union"—otherwise Belgium, France, Italy, Switzerland, and Greece. The object of the inquiry and report was to obtain from our representatives and consuls abroad all the information which it might be in their power to get with regard to the production and distribution of silver, the exports and imports of that metal, coinage legislation respecting currency, and any facts accounting for the depreciation in value of the metal next in importance to gold, though gold in India showed, at the same time an increasing abundance. Switzerland, to meet the crisis, ceased her silver issue, while France, Belgium, and Italy, expanded it up to the point permitted by law, all these countries exceeding, indeed, by three times the gold coinage of 1874. But the "Latin Union" takes precedence of all others, for we find it stated that "the aggregate coinage in the Latin Union States from 1795 in France, from 1862 in Italy, from 1832 in Belgium, and from 1850 in Switzerland, added to the ancient coins of Italy, which have not been demolished, amounts to 8,841,000,000 lire in gold, and 5,847,000 lire in silver, These appear to be formidable figures, but it must be remembered that the lire is only the equivalent of a French franc, and worth, therefore, tenpence. Holland, in particular, has insisted of late on the purity of her specie, and has lately passed bills, substituting a bronze for a copper circulation, while prohibiting the use, within her territories, of foreign coins in copper, nickel, and even bronze. By Germany the subject has been long discussed, though without any distinct decision being arrived at; and Sweden has taken advantage of her silver mines to open a valuable market in London. In Portugal, on the other hand, silver money, when above a certain amount, is not a legal tender, though English sovereigns and half-sovereigns are; while in Russia the paper representatives of the Muscovite dollar is more in demand than the precious metal itself. Not so in America, where the prompt redemption of "greenbacks" is an universal desire, though they have by no means lost credit as a national currency. As for Brazil, if the fact may be stated without the suspicion of a joke, it exports nearly all its silver to the river Plate.—*The Echo.*

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SPECIAL NOTICE.

COMMENCEMENT OF OUR THIRD VOLUME.

It is with no ordinary satisfaction that we (with the last Number) entered upon the third year of the publication of this Journal, which has already established for itself the reputation of being the recognized organ of the various trades represented by our pages.

Modesty prevents us applying the motto, "*Success the Reward of Merit;*" nevertheless, we may say that as we sit at our editorial desk and reflect on the past history of our young Journal, a feeling of (we trust pardonable) pride arises within us, when we consider the many encouragements and expressions of satisfaction with which our endeavours have been attended.

Although we do not desire to sound our "own trumpet," we can yet conscientiously say that the usefulness of this Journal is quite evident from the fact of its circulation steadily increasing. At its first appearance, it had to "introduce *itself*" to the trade, many of whom hailed it at once as a welcome visitor, but feared that scarcely sufficient nourishment would be found to sustain it. Such fear, has, however, we are glad to say, proved groundless; and from a small circulation it has grown larger and larger, until it now counts among its patron subscribers *in all parts of the world.* Scarcely a week passes without our receiving communications from the Colonies and different quarters of the globe, expressing high appreciation of our endeavours, accompanied with requests to be supplied with the Journal, which gives us additional encouragement in our work. We enter upon our Third Volume with earnest hope that the confidence hitherto received will be continued, and that increased support will rally around us in our determination to fulfil our duty as journalists, by endeavouring to place before our readers a Trade Journal worthy of their patronage. Such will be the aim kept in our view, and one which we hope will be found fully realized.

To those of our subscribers who have not yet forwarded their annual subscription for the ensuing volume, we would say, "Never postpone till to-morrow what you can accomplish to-day." The amount is trifling, the trouble still less; procure a Post Office Order for five shillings, address it to our office, and be sure of receiving in return full value in instructive and interesting information necessary to every man in the trade.

Mr. Herman Bush, of 14, Mytongate, Hull, has undertaken the agency of this "Journal" in that town and surrounding district, and is fully authorized to receive subscriptions, and to arrange for advertisements in our behalf.

PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

2532. Frederick Bogen, of 17, Adelaide-road, N.W., in the county of Middlesex, for an invention of "Improvements in barometers and apparatus connected therewith."—Dated 30th June, 1877.

2577. William Robert Lake, of the firm of Haseltine, Lake, & Co., patent agents, Southampton-buildings, London, for an invention of "Improvements in machinery for engraving and chasing metals, and for cutting wood, stone, and other like materials." A communication to him from abroad, by Harvey Klapp Flagler, of Boston, Massachusetts, United States of America.—Dated 4th July, 1877.

2593. William Morgan-Brown, of the firm of Brandon & Morgan-Brown, engineers and patent agents, of 38, Southampton-buildings, London, and 1, Rue Laffite, Paris, for an invention of "An improved watch-winding attachment for watches."—A communication to him from abroad by William H. Bracy, of Boston, county of Suffolk, Massachusetts, United States of America.—Dated 5th July, 1877.

2708. Henry Gardner, of the firm of Robertson, Brooman, & Co., of 166, Fleet-street, in the city of London, patent agents, for an invention of "An improved pyrometer or thermometrical indicator."—A communication to him from abroad by Messieurs Joseph Antoine Tremeschini, engineer, and Felix Lion, junior, manufacturer of barometers, both residing at Paris, France.—Dated 14th July, 1877.

2720. George Lund, of the firm of Lund & Blockley, of 42, Pall Mall, in the city of Westminster, manufacturers, for an invention of "Improvements in apparatus for synchronizing or setting clocks or other timekeepers."—Dated 16th July, 1877.

2754. Frank William Haddan, of the firm of Herbert and Company, Patent Agents, of 67, Strand, in the city of Westminster, Civil Engineer, for an invention of "Improved apparatus and process for separating silver and other precious metals from lead."—A communication to him from abroad by Asahel Knowlton Eaton, of Brooklyn, state of New York, United States of America.—Dated 19th July, 1877.

2770. Alexander MacMillan, of the city of London, manufacturer, for an invention of "Improvements in solitaires, studs, and other fastenings.—Dated 20th July, 1877.

2772. Ernest de Pass, of Fleet-chambers, 68, Fleet-street, in the city of London, Patent Agent, for an invention of "Certain improvements in Bozérian's barometer."—A communication to him from abroad by Gaston Eugène Elie Bozérian, of 17, Boulevart Saint Martin, Paris, France.—Dated 20th July, 1877.

2807. Farnham Maxwell-Lyte, of the Scientific Club, Savile-row, in the county of Middlesex, and at present of Paris, in the republic of France, for an invention of "Improvements in treating ores containing silver and certain of its compounds, copper and certain of its compounds, lead and certain of its compounds, either severally or combined, and reducing and extracting expeditiously each or any of these metals therefrom, and separating them."—Dated 23rd July, 1877.

2837. George Henry Bricknell, of Birmingham, in the county of Warwick, Jeweller, for an invention of "Improvements in fastenings for buttons, shirt studs, solitaires, and other articles of jewellery and dress."—Dated 25th July, 1877.

2850. Peter Lawson, of Hatton-garden, in the county of Middlesex, for an invention of "Improvements in the construction of solitaires, studs, and buttons."—Dated 26th July, 1877.

2894. Alexander Melville Clark, of 53, Chancery-lane, in the county of Middlesex, Patent Agent, for an invention of "Improvements in stop watches."—A communication to him from abroad by Henri Alfred Lugrin and Prosper Nordmann, both of the city, county, and state of New York, United States of America.—Dated 28th July, 1877.

Notices to Proceed.

728. George Woods and Edwin Woods, both of Warrington, in the county of Lancaster, wire-drawers, have given notice in respect of the invention of "Improvements in annealing iron and steel wire."

1518. Axel Gabriel Frykman, of 22, St. Peter's-square, Hammersmith, London, and Stockholm, in Sweden, has given notice in respect of the invention of "Improvements in the manufacture of iron and steel, and in apparatus employed therein."

496. Francis Herbert Wenham, of 8, Oxford-road, Ealing, in the county of Middlesex, engineer, has given notice at the office of the Commissioners, of his intention to proceed with his application for Letters Patent for the invention of "An improved object stage for microscopes."

1511. Albert Barker, of New Bond-street, in the county of Middlesex, dressing-case maker and silversmith, has given notice in respect of the invention of "Improvements in keys for locks, latches, watches, clocks, and other like articles, applicable also to cocks or taps."

1853. Louis Beaver, of Manchester, in the county of Lancaster, goldsmith, has given notice in respect of the invention of "Improvements in scarf-rings."

1580. Albert Barker, of New Bond-street, in the county of Middlesex, silversmith and dressing-case maker, has given notice in respect of the invention of "Improvements in pencil-cases, pen-holders, toothpicks, and other similar articles, such improvements being also applicable to necklets and bracelets."

2051. George Bower, of St. Neots, in the county of Huntingdon, has given notice in respect of the invention of "Improvements in the treatment of metallic surfaces, so as to effect their protection from atmospheric and other influences."

1976. Maurice Nelson, in the name of Veit & Nelson, of 11, Rue Bergère, in the city of Paris, merchants, and Henry Pic, of 12, Rue de Poiton, in the city of Paris, manufacturer of mourning jewellery, have given notice in respect of the invention of "Improvements in articles of mourning or finery and ornaments."

2577. William Robert Lake, of the firm of Haseltine, Lake, & Co., patent agents, Southampton-buildings, London, has given notice in respect of the invention of "Improvements in machinery for engraving and chasing metals, and for cutting wood, stone, and other like materials."—A communication to him from abroad by Harvey Klapp Flagler, of Boston, Massachusetts, United States of America.

1023. Edward Thomas Hughes, of the firm of Hughes and son, Patent Agent, 123, Chancery Lane, London, has given notice in respect of the invention of "Improvements in apparatus for electro-plating wire."—A communication to him from abroad by William Wallace, of Ansonia, in the county of New Haven and state of Connecticut, United States of America, Manufacturer.

1094. Arthur Charles Henderson, of 6, Southampton-buildings, Holborn, in the county of Middlesex, Patent Agent, has given notice in respect of the invention of "Improvements in the application of alarms to watches."—A communication to him from abroad by Frederick Dessert, Watchmaker, a person resident at Besancon, in the department of Doubs, in the republic of France.

1116. William Blanch Brain, of Cinderford, in the county of Gloucester, has given notice in respect of the invention of "Improvements in electric batteries, together with the mode of and apparatus for separating iron and other metals from their ores, and in generating electricity and thermo-electricity by or during the electro deposition of such ores.

Grants of Provisional Protection for Six Months.

1880. To Johann Anton Benedict von Castelberg, of 58, Holborn Viaduct, in the city of London, for the invention of "Improvements in watches."—A communication to him from abroad by Cétile Domon, of Bienne, Switzerland.

1976. To Maurice Nelson, in the name of Veit & Nelson, of 11, Rue Bergère, in the city of Paris, merchants, and Henry Pic, of 12, Rue de Poiton, in the city of Paris, manufacturer of mourning jewellery, for the invention of "Improvements in articles of mourning or finery and ornaments."

2272. To Gustave Fauvel, optician, of Rouen, for the inventien of "Improvements in and applicable to spectacles and other glasses to be worn on the nose."

2346. To Benjamin Martin Petersen, of Mark-lane, London, merchant, for the invention of "Improvements in fastenings for studs, solitaires, and other similar articles."

2324. To Charles William Cooper, of Birmingham, in the county of Warwick, Electro-Plater and Gilder, and Reuben Cornelius Lilly, of Birmingham aforesaid, Jeweller, for the invention of "Improvements in watch protectors, which improvements may also be used for protecting lockets, charms, chains, and other like articles of jewellery."

2360. To George List, of Handsworth, in the county of Stafford, Agency Inspector of the Life Association of Scotland, and George Rowland List, of Handsworth aforesaid, Manufacturing Jeweller, for the invention of "An improvement or improvements in suspenders for lockets and other like articles of jewellery."

2386. To William Holmes Haigh, of Featherstone-buildings, Holborn, in the county of Middlesex, for the invention of "Improvements in astronomical apparatus for illustrating the position of every part of the heavens, with regard to every part of the earth at every period of the year."

2593. To William Morgan-Brown, of the firm of Brandon and Morgan-Brown, Engineers and Patent Agents, of 38, Southampton-buildings, London, and 1, Rue Laffite, Paris, for the invention of "An improved watch-winding attachment for watches."—A communication to him from abroad by William H. Bracy, of Boston, county of Suffolk, Massachusetts, United States of America.

Patents Sealed.

140. John Matthew May, of Hatton-garden, in the county of Middlesex, merchant, for an invention of "Improvements connected with the manufacture of clock-cases, barometer-cases, thermometer-cases, and other like cases."—Dated 11th January, 1877.

296. John Thomas Nicholls, of Southampton-buildings, Holborn, for an invention of "Improvements in watch-guards or protectors."—Dated 24th January, 1877.

302. John Lysaght, of St. Vincent's Corrugated Iron Works, Bristol, for an invention of "Improvements in galvanizing and metal-coating apparatus."—Dated 24th January, 1877.

540. Frederick Delacourt Blyth, of Fenchurch-street, in the city of London, merchant, for an invention of "Improvements in machinery for the manufacture of dowels and pins from metal rod or wire, and in the operations connected therewith."—Dated 8th February, 1877.

191. Harrison Mill Frodsham, of the Strand, in the county of Middlesex, chronometer-maker, for an invention of "Improvements in equimotive escapements for watches, clocks, and other time-keepers."—Dated 15th January, 1877.

265. John Hollway, of the firm of Hollway Brothers, of 7, Jeffrey's Square, in the city of London, for an invention of "Certain improvements in the production of metals or metallic alloys, and in the process employed therefore."—Dated 20th January, 1877.

486. William Drake, of Sheffield, in the county of York, for an invention of "Improvements in the manufacture of iron, steel, and other metals."—Dated 5th February, 1877.

442. Charles Moreau, optician, of the city of Paris, in the republic of France, for an invention of "Improvements in opera, field, and marine glasses."—Dated 2nd February, 1877.

Patents on which the Stamp Duty of 50s. has been Paid, and Dates of their Production for Certificate.

2688. Thomas William Dowler, of Birmingham, in the county of Warwick, Manufacturer, and John Smith, of Birmingham, aforesaid, Manufacturer, for an invention of "Improvements in fastenings for solitaires, sleeve links, gloves, and other articles of jewellery and dress."—Dated 3rd August, 1874.

Patents which have become Void.

2418, William Robert Lake, of the firm of Haseltine, Lake, and Co. Patent Agents, Southampton-buildings, London, for an invention of "An improved regulator for spring clocks and watches."—A communication to him from abroad by Matthew Muchin, of Riga, in the empire of Russia.—Dated 9th July, 1874.

2443. John Boultbee Brooks, of Birmingham, in the county of Warwick, Manufacturer, for an invention of "Improvements in sleeve links and solitaires and other fastenings for jewellery and dress."—Dated 11th July, 1874.

Patents Granted in Foreign States.

Belgium.

42,411. E. J. de Wogan, of Brussels for "A solar watch."—Dated 9th June, 1877.

42,427. C. P. Madelaine and H. E. Blotaque, for an important invention of "An artistic metallic casket for jewellery."—Dated 12th June, 1877.—(French Patent, 23rd December, 1876.)

42,459. J. Lancaster, of St. Gilles-Brussels, for "Soldering."—Dated 16th June, 1877.

42,485. C. A. Mayrhofer, for "A pneumatic precision clock with an anchor-escapement, and hydro-pneumatic motion."—Dated 20th June, 1877.

42,536. Mrs. L. Rain, for "Stud-fasteners."—Dated 29th June, 1877.

42,524, L. M. Detenre, of Brussels, for an imported invention of "Manufacturing jewellery of galvanized wax."—Dated 27th June, 1877.—(French Patent, 28th February, 1877.)

Austria.

16. M. Fauner, of Bozen, for "Improvements in repeating clocks with a single main-wheel in the movement and no wheels in the striking-work."—1 year.—(Secret.)—Dated 22nd March, 1877.

United States of America.

185,832. Robert Neumann, of Konigsberg, i. P., Prussia, for "Burglar-proof safes."—Application filed 4th January, 1876.

185,867. Chas. S. Moseley, of Elgin Ill., for "Plates for stem-winding watches."—Application filed 6th December, 1876.

186,022. John S. Spencer, of New York, N.Y., for "Eyeglasses."—Application filed 1st September, 1876.

186,107. A. S. Buckelew, of Jersey city, N J., for "Methods of making lift-springs for watches."—Application filed 22nd May, 1876.

Grand Duchy of Baden.

11. A. Goll & R. A. Schlund, of Frankfort-on-the-Maine, for "Cuff-studs and folder-holder."—3 years.—Dated 7th January, 1877.

37. P. Wehrle, of Rothenbach, for "A calendar-clock."—3 years.—Dated 23rd February, 1877.

38. T. Weisser, of Villingen, for "Modifications in the construction of Wilde's calendar-clock."—3 years.—Dated 24th February, 1877.

84. C. Krieger & Co., of Pforzheim, for "Manufacturing studs for shirts and cuffs with massive bottoms."—3 years.—Dated 22nd May, 1877.

85. G. Rau, of Pforzheim, for "Manufacturing studs for shirts and cuffs of one piece."—3 years.—Dated 22nd May, 1877.

109. C. & L. Wilde, of Villingen, a patent of prolongation for "A calendar-clock."—3 years.—Dated 13th June, 1877.—(Original Patent, 5th July, 1874.)

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A MONTHLY TRADE JOURNAL,

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

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HOROLOGY.

(Continued from page 25.)

XXVII.—Its Relations to Astronomy.

By G. B. Miller.

HOWEVER accurate an instrument for measuring time may be, it would be of little use for close observation, unless we had some standard by which to test its performance. We look to astronomy to furnish us with this desideratum, and do not look in vain. The mean sidereal day, measured by the time elapsed between any two consecutive transits of any star at the same meridian, and the mean sidereal year—which is the time included between two consecutive returns of the sun to the same star—are immutable units with which all great periods of time are compared: the oscillations of an isochronous pendulum, affording us a means of correctly dividing the intermediate space into hours and days.

We must premise that the entire theory of taking time by sidereal observations is based on angular motion, the mensuration of one of the angles of motion giving a measurement of space, so that to say space, or distance, is equivalent to saying time. From noon of one day to noon of another is the whole problem to be solved by correct division. The astronomical day begins at noon, but in civil law the day is dated from midnight. .So in the year the astronomical day is dated December 31st, while in common reckoning the 1st of January is the initial point. This day is divided into 24 hours, counted in England, America, and the most of the continental nations in Europe, by 12 and 12. The French astronomers, however, adopted the decimal system for ease in the computation. Thus they divided the day into 10 hours, the hour into 100 minutes, and the minute into 100 seconds. This plan was in conformity with the French system of decimal weights and measures. The French system presents some features well worthy of adoption, as it gives results so much more easy in computation—a facility unattainable in the common division; yet it did not come into general use in other countries, and although some French astronomers still hold to the system, it is gradually dying out. At one time during the Revolution in France, a clock in the gardens of the Tuileries was regulated to show time by the decimal system.

For the horologist the mean length of the day is sufficient to show the rate of his instrument for that particular day, but the astronomical and civil division requires a much longer period of observation. This is obtained by the position of the mean annual equinoxes or solstices, and is estimated from the winter solstice, the middle of the long annual night under the North Pole, and the period between this solstice and its return is a natural cycle, peculiarly suited for a standard of measurement.

Even with such a standard as the civil year of 365d. 5h. 48m. 49·7s., the incommensurability that exists between the length of the day and the real place of the sun, makes it very difficult to adjust the ratio of both in whole uumbers. Were we to return to the point in the earth's orbit in exactly 365 days, we would have precisely the same number of days in each year, and the sun would be at the same point in the ecliptic at the same second at the beginning and end of the year. There is, however, a fraction of a day, so that a solar year and civil are not of equal duration. It is thus we have our bissextile year, from the fact that the inequality amounts to nearly a quarter of a day, so that in 4 years we have a whole day's gain, but not exactly because a fraction still remains to be accounted for. Now, if we should suppress the one day of leap year once at the end of each three out of four centuries, the civil would be within a very small fraction equal to the solar year; as given by observation this small fraction would be almost entirely eliminated, provided we suppressed the bissextile at the end of every 4000 years. Were this fraction neglected, the beginning of the new civil year would precede the tropical by just that much, so that in the course of 1507 years the whole day's difference would be obtained.

The Egyptian year was dated from the heliacal rising of the star Sirius, it contained only 365 days. By easy computation it can be shown that in every 1461 years a whole year was lost. This cycle was called the Sotbaic period, in which the heliacal rising of Sirius passed through the whole year and took place again on the same day. The commencement of that cycle took place 1322 years before Christ. The year by the Roman calendar was dated by Julius Cæsar the 1st of January, that being the day of the new moon immediately following the winter solstice in the 707th year of Rome. Christ's nativity is dated on the 25th of December, in Cæsar's 45th year, and the 46th year of the Julian calendar is assumed to be the 1st year of our era. The preceding year is designated by chronologists the 1st year before Christ, the dates thence running backwards the same as they run forward, subsequent to that period.

Astronomically, that year is registered 0; the astronomical year begins at noon on the 31st of December, and the date of any observation expresses the number of days and hours which have actually elapsed since that time, the 31st of December—year 0. The year is divided into months by old and almost universal consent, but the period of seven days is by far the most permanent division of a rotation of the earth around the sun. It was the division long before the historic period. The Brahmins in India used it with the same names as at the present day. The Jews, Arabs, Egyptians, and Assyrians, also used the same division with different names. "It has survived the fall of empires, and has existed among all successive generations, a proof of their common origin." Nothing can be more interesting in the study of astronomy than its chronological value. La Place says: "Whole nations have been swept from the earth, with their languages, arts, and sciences, leaving but confused masses of ruins to mark the place where mighty cities stood; their history, with but the exception of a few doubtful traditions, has perished; but the perfection of their astronomical observations marks their high antiquity, fixes the period of their existence, and proves that even at that early time they must have made considerable progress in science."

The earth revolving around the sun in an ellipse, the position of the major axis of the orbit would indicate something in regard to era in astronomy extending not only beyond the historical period, but so far back in the past that imagination is almost at fault. The position of the major axis of the orbit depends on the direct motion of the perigee and the precession of the equinoxes conjointly, the annual motions respectively being 11·8″ and 50·1″, the two combined motions being 61·9″ annually. A tropical revolution is made in 209·84 years. This being a constant quantity, we may ascertain when the line of the major axis coincided with the line of the equinoxes. This occurrence took place about 4000 or 4090 years before the year 0. In the year 6483 the major axis will again coincide with the line of equinoxes, but then the solar perigee will coincide with the vernal equinox. So it will be seen that the period of revolution is 20,966 years; but, in the progress of this revolution, there must have been a time when the major axis was perpendicular to the line of the equinoxes. A simple calculation will show that the eventful year was 1250; and so important is this event considered, that La Place, the immortal author of the *Mechanique Celeste*, proposed to make the vernal equinox of this year the initial day of the year 1 of our era. Again, at the solstices, the sun is at the greatest distance from the equator, consequently the declination of the sun is equal to the obliquity of the ecliptic. The length of a shadow cast at noonday from the stile of an ordinary sun-dial would accurately determine the precise time on which this position occurs.

Though wanting in accuracy, such a measurement is of interest, from the fact that there are recorded observations of this kind that were taken in the city of Layang, in China, 1100 years before our present era is dated. This observation gives the zenith distance of the sun at the moment of the observation. Half the sum of the zenith distances gives the latitude, and half their difference gives the obliquity of the ecliptic at the period. Now the law of the variation of the ecliptic is well known, and modern computation has verified both the moment of taking the observation and the latitude of the place. Eclipses were the foundation of the whole of the Chinese chronology, and recorded observations prove the civilization of that strange race for 4700 years.

Horology, with astronomy, was not neglected even as early as 3102 years before Christ, as the following will show:—The cycles of Jupiter and Saturn are very unequal, the latter being a period of 918 years; the mean motion of the two planets was determined by the Indians in that part of the respective orbits where Saturn's motion was the slowest, and Jupiter's the most rapid. This observed event must have been 3102 years before, and 1491 after the year 0; but the record shows that the observation was taken before the last-named date.

Since both solar and sidereal time is estimated from the passage of the sun and the equinoctial point across the meridian of the place of observation, the time will vary in different places by as much as the passage precedes each. It being obvious that when the sun is in the meridian at any one place it is midnight at a point on the earth's surface diametrically opposite, so an observation taken at different places, at the same moment of absolute time, will be recorded as having happened at different times. Therefore, when a comparison of these different observations is to be made, it becomes necessary to reduce them by computation to what the result would have been had they been taken under the same meridian at the same moment of absolute time. Sir John Herschel proposed to employ mean equinoctial time, which is the same for all the world. It is the time elapsed from the moment the mean sun enters the mean vernal equinox, and is reckoned in mean solar days and parts of days. This difference in time is really the angular motion of the earth, and, by measuring it, the longtitude of any place on the surface of the earth can be determined, provided we have a standard point of departure, and an instrument capable of accurately dividing the time into small quantities during its transit from the meridian in which it was rated.

As will be hereafter shown, the axis of the earth's rotation is invariable. Were the position of the majer axis of the earth's orbit as immutable, an observation of any star on the meridan, taken at any place, would always be the same. Again, the form of the earth has an important effect—the equatorial diameter exceeds the polar, thus giving a large excess of matter at the equator. Now the attraction of an external body not only draws another to it in its whole mass, but, as the force of attraction is inversely as the square of the distance, it follows that the attracted body would be revolved on its own centre of gravity until its majer diameter was in a straight line with the attracting body.

The sun and moon are both attracting bodies for the earth; the plane of the equator is at an angle to the plane of the ecliptic of 23° 27′ 34·69″, and the plane of the moon's orbit is inclined to it 5° 8′ 47·9″. Now, from the oblate form of the earth, the sun and moon, acting obliquely and unequally, urge the plane of the equator from its own position, from east to west, thus changing the equinoctial points to the extent of 50·41″ annually.

This action, were it not compensated by another force, would in time alter the angle of the ecliptic until the equatorial plane and the ecliptic coincided. There are few but have seen the philosophical toy called the Gyrascope. This toy, on a miniature scale, gives a fine illustration of the force brought in to correct the combined action of the sun and moon in the obliquity of the equator. The rotation of the earth is held in its own plane by its own revolution, the same as the gyrascope seems to overcome the laws of gravitation by its force of revolution. But not only do the sun and moon disturb the plane of the ecliptic, but the action of other planets on the earth and sun is to be taken into account. A very slow variation in the position of the plane of the ecliptic, in relation to the plane of the equator, is observed from these influences. It must be remembered that a very slight deviation in the angle can and would be detected by observation with modern instruments. We do find that this attraction effects the inclination of the ecliptic to the equator of 0·31″ annually.

This motion is entirely independent of the form of the earth. Now, if we assume that the sun and moon give the equinoctial points a retrograde motion in the ecliptic, we must deduct the influence of the planets. We may then calculate the mean disturbance by subtracting the latter from the former—the difference is settled by both theory and observation to be 50·1″ annually. This motion of the equinoxes is called the precession of equinoxes. Its consideration forms a very important element in the estimation of time, as the position of the various fixed stars, though so very distant, are all affected in longitude by this quantity of 50·1″, being an increase of longitude. Therefore, if we were to calculate the position of any given star in order to get a transit for mean time, or true time, we must take this quantity into consideration. The increase is so great that the earliest astronomers, even with their imperfect modes of observation, detected it. Hipparchus, 128 years before Christ, compared his own observations with those of

Timocharis 153 years before. He found the solution of the problem the same as Diophantus found the solution of the squares and cubes by analysis. In the time of Hipparchus the sun was at a point 30° in advance of its present position, for it then entered into the constellation of Aries near the vernal equinox.

At the present time the position of the equinoctial points show a recession of the whole, 30° 1′ 40·2″. At this rate of motion the constellations called the signs of the zodiac are some distance from the divisions of the ecliptic that bear their names. At the rate of 50·1″ the whole revolution of the equinoctial points will be accomplished in 25,868 years; but this is again modified, because the precession must vary in different centuries, for the following reasons: the sun's motion is direct, the precession retrograde; therefore the sun arrives at the equator sooner than he does at the same star of observation. Now, the tropical year is 365d. 5h. 48m. 49.7s.; and as the precession is exactly 50·1″, we must suppose it takes some time for the sun to move through that arc. By direct observation it is found that the time required for such translation is 20′ 19·6″. By adding this amount to the tropical year we have the sidereal year of 365d. 6h. 9m. 9.6s. in mean solar days. This amount of precession has been on the increase since the days of its first recorder, Hipparchus, as the augmentation amounts to no less than 0.455″. By adding that to the known precession, we find that the civil year is shorter now by 4·21″ than in his time; but, as a great division of time, the year can be changed by this cause not more than 43″.

The action of the moon on the accumulation of matter at the earth's equator is a source of disturbance that, in very accurate observations for time, should be eliminated. Thus the moon, with the conjoint action of the sun, depending on relative position, causes the pole of the equator to describe a small eclipse in the heavens with axis of 18·5″ for the major and 13·674″ for the minor; the longer axis being directed to the pole of the ecliptic. This inequality has a period of 19 years, it being equal to the revolution of the nodes of the lunar orbit. The combination of these disturbances changes, by a small quantity, the position of the polar axis of the earth in regard to the stars, but not in regard to its own surface. With so many disturbing causes we must add that of Jupiter, whose attraction is diminishing the obliquity of the ecliptic by 0·475″, according to M. Bessel.

(To be continued.)

OLD WATCHMAKERS.

On the 19th of March, 1775, died, aged 75, Daniel Quare, an eminent watchmaker. He was successor to George Graham, who died in 1725, at the age of 78. Graham was himself successor to Thomas Tompion, who died in 1713, aged 75. Tompion had been a blacksmith. Before his time, watches were of rude construction. In the reign of Charles I. they were somewhat improved. The king's own watch, which is still preserved, has a catgut string instead of a chain; and indeed, watches of that construction were in use during a very considerable time after this period.

The Rev. Mark Noble says, "When I was young I was indulged with taking an ancient family watch to school. It was very small and in silver cases, with a catgut string instead of a chain, and it required to be wound up every twelve hours. It was made in Holland. At this moment I feel ashamed to say I pulled it to pieces, and sold the movements for whirligigs." Robert Hooke invented the double balance in 1658, which Tompion completed in 1675, and presented to Charles II. And two of them were sent to the Dauphin of France, where Huyghens had obtained a patent for spiral spring watches, which idea, it is believed, he obtained from the information of Mr. Oldenburg, who himself devised it from Mr. Derham. It is allowed, however, that Huyghens did invent those watches which went without strings or chains.

Barlow, in the reign of James II., is said to have discovered the method of making striking watches; but Quare's being judged superior by the Privy Council, Barlow did not obtain a patent. Tompion's watches continued valuable for a long time, owing to their being large, and the wheels having been made of well-tempered brass.

The three eminent watchmakers in succession, Tompion, Graham, and Quare were members of the Society of Friends, or Quakers.

PRACTICAL INFORMATION FOR THE TRADE.

Dingler's Journal announces that M. C. Winckler has succeeded in fusing nickel and cobalt in ingots of from two to five kilos, by using refractory crucibles, maintaining a very high temperature, keeping carbon and silica from contact with the melted metal, and by carefully excluding the oxygen of the atmosphere during the progress of the casting.

New Metallingical Treatment of Nickel.—Mr. Hersel proposes the following treatment of the oxides of nickel, and especially of the hydrosilicate of nickel and of magnesia. The nickel oxides are mixed with alkaline sulphides or persulphides, or with alkaline earths variable according to the composition of the ore and the nature of the gangue. The mixture is melted in a suitable furnace. The sulphides or the alkaline earths react on the oxides and on the silicate of nickel formed by double decomposition of the nickel sulphide and the alkaline silicates. The gangue combines with the melted mass on the furnace hearth and produces scoriae; from the latter the nickel sulphide is separated in the same apparatus. Fusion gives. 1. Sulphide of nickel freed almost completely from sulphide of iron. 2. Alkalies or alkaline earths in excess. 3. Silicates forming slag. It remains only to transform the sulphide of nickel into oxide and to treat the latter according to the methods commonly known.

Investigations on Electro Deposition.—At a recent session of the French Academy of Sciences, M. Tamin presented, in behalf of M. Gramme, a note containing many new facts relative to the weight of galvanic deposits which may be obtained per unit of mechanical work by using the magneto-electric machines of which M. Gramme is the inventor. Four series of experiments are summarized. In the first the baths, in variable number were coupled as for quantity. The results showed that the deposit per foot-pound of energy expended does not vary with the augmentation of the surfaces of the anodes. In the second series the baths were connected as for tension. Their number varied from one to forty-eight, but all had electrodes of like extent. The results obtained prove that the deposits of copper per foot-pound augments with the number of baths. In the third series the intensity of the cement was maintained constant, while the surface of the anodes and, at the same time, the number of the baths were augmented. These experiments demonstrated that the expenditure of work in electrolysis may be considered as well when soluble anodes are employed. In the fourth series, insoluble anodes were used. A smaller deposit per foot-pound and considerable polarization resulted. M. Gramme's note throws some new light in the question of galvanic deposits, and his experiments will be of much service to the industries in which magneto-electric machines are rapidly supplanting galvanic batteries. The first apparatus densed by the inventor gave a deposit of 123 grains of silver per hour and per kilogrammeter 7·04 foot-pounds. At present Mr. Wohlwill of Hamburg reports that he has a Gramme-machine that deposits 94.6 pounds of silver with 15 horse-power, which corresponds to 616 grains of silver per hour and per kilogrammeter. M. Gramme considers that by the aid of his recent investigations he will be able to obtain a deposit above 3,080 grains per same units.—*Scientific American.*

New Stellar Spectroscope.—Mon. Mouton presented a spectroscopic telescope designed for stellar observations before the "French Physical Society." The instrument is quite small and may be adopted to telescopes of any kind. It consists essentially of a small telescope containing one or more direct vision prisms between the eye-piece and objective. Near the objective and outside is the slit. Finally, outside the slit is another cylindrical telescope which produces in the slit a linear image of the star. The collimator is suppressed and the objective of the spectroscope projects upon the eye-piece simply the image of the slit. The loss of light is said to be much less than is the case with ordinary spectroscopes.

Monsieur Dodé recommends the following process for coating cast iron, whether rough or enamelled, with platinum. The metallic articles are first moistened by means of a brush dipped in oil of turpentine, then immersed in a mixture of borate of lead and oxide of copper, and baked in an oven. When thus prepared, they are dipped into a mixture of borate of lead, litharge (or massicot), chloride of platinum, ordinary ether, oil of lavender, and amylic ether, and then heated.

THE CAUSES OF THE BREAKING OF MAINSPRINGS AND ELECTRICAL INFLUENCES.

By H. Reinecke.

EVERY mainspring must eventually reach a point at which it will break. Continued concussion will burst a cannon, break an axle, and cause an iron rail to snap. Repeated bending and unbending will destroy the cohesion, and break any piece of metal. As the breaking of a mainspring therefore cannot be prevented, we can only consider those conditions which will hasten or retard the occurrence of the inevitable. In discussing the subject from this standpoint, the following points will furnish us with matter for argument:—

1. Temper and quality of steel. 2. Dimensions. 3. Treatment. 4. Change of temperature. 5. Crystallization, decarbonization and electrical influences. 1. Steel consists of iron and carbon. When we heat it in the fire for the purpose of hardening the carbon makes an effort to set itself free; while in this condition we suddenly immerse it in some cold fluid; the carbon crystallizes, forms as it were diamond-like molecules permeating the iron, and the steel is hard. It will now cut glass. This is a theory, plausible, rational, and perhaps a true one. The microscope might verify it, and, for want of a better one, we might accept it. We draw the temper to a blue; a retrograde chemical change takes place, by bluing the steel it slightly increases in size; a coating is formed, to some degree impervious and dense, inside of which the molecules or particles arrange themselves. This imparts elasticity. Remove the blue and a portion of the elasticity is gone. A blue spring has therefore more force or resistance than a white one.

An inherent defect might exist in a spring on account of the unequal distribution of the carbon throughout the steel, producing too high a temper in some one part, and the same defect may be produced by unequal heating in hardening, disturbing the local equilibrium of the carbon. Defects of this kind cannot be detected by the eye, and breakages from such a cause can only be guarded against by procuring springs of a recognized good quality.

2. Some dimensions are preferable to others. A broad and weak spring is preferable to a narrow and strong one, both having the same force, because a piece of steel being bent when thin does not suffer the same amount of displacement of particles as a thick one, the convex side in the first being nearer its fulcrum or the point on which it bends or moves. A thin piece of glass will bend, a thick piece will break from the slightest strain. A desirable proportion of the spring would be a slight tapering down towards the inner coil, as the spring would then arrange itself more concentrically around the arbor. This, however, can only be done with springs for fusee watches; the best form of those for going barrels is a uniform thickness throughout.

3. If we draw a mainspring across the empty space in a barrel, by winding it close around the arbor, we have more coils than when the spring is at rest against the side of the barrel. The difference between the numbers of the two gives us the number of turns the mainspring will afford us for winding. Should the empty space between the spring and the arbor be large, and we use the entire force of the spring, or in other words, we have no fusee and no stopwork, the strain on the spring will be greater, and it will break sooner than if there was less space. What would be an advantage with a limit to the use of the force is a disadvantage in the contrary sense. The use of the force of the spring without limitation (stopwork, &c.), begets undue strain, and coil friction removes the blue from the spring, lessens its elastic force, exposes a more porous surface, and makes it more liable to a fracture. The same evil, however, is often produced in the barrel of a fusee watch, or in a going barrel with stopwork, by setting up the spring to its full capacity in order to overcome some obscure defect in the movement, or a fault troublesome to be corrected, or to get a large vibration of the balance. This too common practice is the cause of more springs breaking than all other causes combined. Any extraneous cause added to this is sure to find the weak spot. The proper condition of a spring is that, when it is in a state of rest, it shall contain about fourteen coils (never less than twelve), the empty space shall be fully one-third of the diameter of the barrel, and the winding arbor shall measure one-third also. The latter should be snailed and form with the beginning of the inner coil of the spring a perfect circle, so as to give the spring as much as possible a concentric action; it should have no projecting hook, and the one in the side of the barrel should be no thicker, if possible, than the thickness of the spring. When all these conditions are fulfilled we have generally six turns of the spring, and by setting up one-half or three-fourths of a turn we have the action of the spring in its best attainable form for a going barrel with four turns. I have referred to the advantage which the fusee offers us in this respect in my last communication. The French clockmakers seem to have an inveterate habit of making the hook on the winding arbor project as much as possible, as if it were to try how much the springs could endure; and I can only explain the comparatively rare occurrence of the breaking of these springs from that cause, by their great breadth and thin body, which also protect them to a great extent, together with the gummy oil used, against the injurious effects of coil friction. Careless handling and winding into the barrel by a tool having too small an arbor may lay the foundation for a future break.

4. When a spring is wound to its full capacity in a barrel without a stopwork or without taking advantage of it, and the temperature should change decidedly from heat to cold, a break is inevitable on account of the contraction of the steel. A break is likely to occur also, even if the spring is not wound to its full capacity, by the contraction taking place suddenly, and affecting at the moment the outside of the spring only as a heated glass chimney will break by a sudden draught of cold air. Breakages of this kind occur more frequently in fall, winter, and spring.

5. All metals, subject to strain, will after continued use crystallize and develop a tendency to return to their natural state. When this takes place they lose their cohesion by exhaustion, and a separation takes place sooner or later according to the amount of strain they have been subjected to. But as steel is more cohesive than almost any other metal it would resist this process of nature for a longer time, if other agents were not at work to decarbonize and thus deteriorate it. The principal agents for this are heat and electricity. It may be said heat is electricity, and electricity is heat. The two are convertible terms. All metals contain latent heat and latent electricity which may be excited by nature, chemical agents and friction.

The main factor in an electrifying machine is a plate of glass (insulator), on which a current is generated by friction—*i.e.*, "frictional electricity." The same is produced by a watch hand rubbing against the watch glass. If this hand happens to be of steel it will be partially destroyed at the point of contact, where something resembling rust will manifest itself. This is produced by electric heat. Most watchmakers have probably noticed it. This friction discharges continual currents through the watch. And what wonder that the watch keeps no time! The rubbing of the coils of the mainspring, one against the other, generates also electricity, particularly in warm weather when the peculiar state of the atmosphere helps the process. This decarbonizes the steel, hence the unaccountable breaking of mainsprings in hot weather. A fire-hardened balance spring, from its unyielding nature has an internal friction of its molecules; hence the settling down of the rate in VERY hot (electric) weather. Different individuals are more or less good conductors of electricity, hence a different rate of a watch with different persons. The more a body absorbs moisture the better conductor of electricity it is. Therefore a blue spring with its closed pores, is a poorer conductor for electricity (magnetism) than a white or porous one.

Galvanic or voltaic electricity is developed when two different metals come in contact, one of which is acted upon by an acid (moisture). A brass barrel containing a steel mainspring with acid oil forms a galvanic battery, stimulated by heat. All oil contains acid more or less in proportion to its impurity. The finer the oil and the smaller the quantity (we must have enough for a lubricator), the less danger of galvanism developing itself. But the atmosphere often furnishes acid (moisture), and causes the battery to act. Heat is generated and the metal is deteriorated. If the brass did not preponderate to such an extent in all chronometers and watches, and as the more powerful and better conductor, led this electricity into the air, it might be difficult to have a timepiece with a balance spring at all. A ship's chronometer is better protected than a pocket watch, by being surrounded by poor conductors or fair insulators; but the moment a watch coming from a cold room is brought in contact with the warm body of the wearer a current commences.

In the tropics, mainsprings surrounded by a brass wire and oiled with common olive oil, become so brittle in a year or two as to break like glass. This is my own experience.

During the subterranean disturbances in the Antilles in the year 1842, when a portion of the city of Point à Pitre in Guadeloupe sunk out of sight into the sea, the spring of a ship's chronometer broke twice during two successive voyages in the same latitude and longitude, previous to and near the scene of the disaster.

Those interested in the further search after information in this respect, I would direct to study the development of fractional and galvanic electricity in a steam engine and a surface condenser.—*New York Jewellers' Circular.*

ENAMELS.

The *Jeweller's Circular* says:—"Mr. Fred Vors, with Messrs. Tiffany & Co., has been contributing a series of letters to the New York *Tribune*, dealing with *bric-a-brac*, in which Mr. Vors is justly regarded as a leading expert. We reprint below that which describes the various kinds of enamel known to collectors:—

"The etymology of the name *bric-a-brac* is rather vague. It evidently comes from the old French expression, '*de bric et de broque*,' which means from right and from left—from hither and thither. The word *bric* signifies, in old French, an instrument used to shoot arrows at birds with, and some etymologists derive the word *brac* from the verb *brocanter*—to sell or exchange, the root of which is Saxon, and also the origin of the word 'broker.' Its signification in pure English is second-hand goods, but has of recent years been used to indicate objects of some artistic value made in olden times, and which are much esteemed by modern collectors. This century is one of collections, ranging in value from defaced postage stamps and wax impressions of seals to watches and snuff-boxes of rare metals, ornamented with precious stones. One of the words most frequently used in bric-a-brac trade is the word 'enamel.' Enamel is simple glass fused on the surface of metals or of earthenware. This art originated in olden times, in the efforts made by art-workers to reproduce the effects so much admired of mosaics, in which precious stones were often used. Colour has always been the key-stone of all styles of decoration, and what better mode of diffusing it on a surface could be found than coloured glass. It was brilliant, could defy both atmospheric influences and time; in one word, coloured glass became the great vehicle of colour in art decoration of all periods. The earliest method thought of to make it adhere to the surface of metals was once the design of the ornament, having been scratched with a graving tool, to cut away the places to be coloured, sinking them slightly below the surface of the metal plate, and then to fill them with powdered glass, which, when exposed to a sufficient heat, would melt, and on cooling become a solid piece of coloured glass or enamel filling exactly the space cut out for it. This method of decoration is styled '*champleve*' or 'surface lifted out.'

"Later a modification of this method is noticeable. In many cases the metal cut away to make room for the enamels formed the largest part of the metal surface; sometimes only thin walls of metal were left to prevent the different colours of glass from mixing together when in a liquid state in the furnace. From this came the style *cloisonne*, or partitioned, where a flat wire, mounted on edge on the plate, follows the tracery of the design and separates the enamels forming the decoration. The Chinese and Japanese always excelled in this style of work. The different cells formed by the fretwork of wire on the surface of thin sheets of metal of which the vases, plates or plaques were made were loaded with the different colours of enamel or powdered glass. They were then "fired," or exposed to a heat sufficient to fuse the glass without melting the metal, but naturally, when withdrawn from the furnace, the powder, becoming a solid body, had shrunk, and this made necessary a second, a third, often a fifth or sixth, filling up after each 'fire.' When the pieces came out the surface was uneven, burnt or blistered; the metal '*cloisons*' were scorched and black. By grinding these down, with stone or files, an even surface was obtained, but the glass lost its lustre and became opaque—just as ground glass differs from polished glass. In most cases this softened the colours and produced a nearer resemblance to stone, for let it be remembered decorative enamels were first intended to imitate or replace costly mosiacs. As an illustration of this one may mention that the Japanese word corresponding to enamel is 'shippo,' and means seven precious stones

"The old art-workers of Dia Nippon claim that they produced their enamels from grinding down precious stones and fusing them on to the surface of the metals. Modern science has demonstrated the impossibility of this operation, though in some cases at first sight the similarity of the enamels found in old specimens of Japanese *cloisonne* may deceive even persons of sound judgment. For instance, in old pieces the turquoise blue has turned green in spots just as the real stone does when old. This is owing to the presence of *alumine* in the enamel acting just as it does in the real stone. For a long time collectors thought that the threads of metal were secured to the surface to be enamelled by solder, but when the Japanese produced cloisonne on porcelain this very much respected belief was shaken. Any metal worker would laugh at the idea of soldering threads of metal on thin copper. The feat would be most extraordinary, and at the first fire the *cloisons* would lie down. The method employed by the Orientals consists in sticking the *cloisons* on with gum, which of course is much more simple then soldering them. They first engrave their design on the metal surface to be enamelled, they then bend their rectangular wire into the shapes corresponding to it, and simply stick them on with a gum prepared from the pips of the quince, a fruit very common in their country. They next prepare a hard, colourless enamel, which they grind to a fine powder without washing it, to retain all the adhesive qualities of the glass, which water might impair. The next operation is to moisten the gum which holds the *cloisons* to the vase with a spray of water, generally blown from the mouth of the operator, and before the gum is dry they powder over it the enamel; this naturally sticks to the gum, and by exposing the piece in a muffle to a sharp, strong fire, the gum is burned away, the enamel fused, and all the wire fretwork stuck to the metal below with the melted glass. The piece is then ready to be "charged" with the coloured enamels. In the sixteenth century French workmen at Limoges succeeded in covering thin copper surfaces with a thin dark coating of enamel. On this they painted decorative subjects in white, for the enameller's palette in Europe in those days was not furnished with the many colours known in the East. The shading of these decorations, which often represented human figures, was produced by successive layers of thin white enamel, which being transparent showed the dark ground under them. For each fresh layer the white grew more opaque, until it became intense white on the high-lights. Each new application of white enamel made necessary a new passage through the fire to unite it to the previous layers, and much risk was run in the operation; but the depth of the shading obtained by this method is so exquisite that even to the present day the artisans of Paris, who excel in this kind of work, have found no substitute for it. Gold is often introduced to help the decoration, but this is added only at the last fire. Sometimes light tints of colour also cover the white to enliven it, but this is also only done in the last stage of the process. In some cases where strong colours are wanted they lay on the copper a thin sheet of gold leaf and cover it with transparent, colourless enamel, which is tinted in red, blue, or green at the end of the enamelling process, producing a semi-transparent effect, which often suggests precious stones.

A Sleeve-Button has been invented in America, the top of which unscrews and permits the name and address of the owner to be placed therein. Outside the button is stamped, "Where I live, see inside." The Superintendent of Police at New York recommends it as specially valuable in the identification of lost children.

Agates.—It is said that the colour of Agates may be darkened by boiling the stones in oil, and then dipping them in sulphuric acid. In this process the oil is absorbed, in the course of boiling, and is afterwards charred by the acid.

Researches on Gold.—In his thermo-chemical researches on gold and its compounds, M. Julius Thomsen has observed that gold separated out forms different solutions, and by dissimilar reducing agents presents allotropic differences, three of which he has studied:—1. Reduced from chloride solution with sulphurous acid, gold forms a balled mass. 2. Reduced similarly from the bromide solution, it forms a very fine dark powder, which retains its powder form even after drying. 3. Reduced from the chloruret, bromuret, or ioduret, with sulphurous acid or hydrogen acid, it forms a very fine powder with metallic brilliancy and yellow colour. These modifications are also distinguished by unequal heat-energy in the several creations.

ENGLISH, AMERICAN, FRENCH, AND GERMAN Periodicals, and recently published Handbook for Refiners, Jewellers, Electroplaters, Watchmakers, and Lapidaries. List free on application to Herman Bush, American Clock Depot and Publishing Agency, Hull, Yorkshire.

THE ENGLISH WATCH COMPANY.

THE great and powerful capital of the Midland Counties has long rejoiced in the handy-work of legions of mechanical inventions, embracing almost the whole circle of the sciences; but, not satisfied with such a superiority, it has added yet another. The Toyshop of the world, not content with nearly all the appliances for killing men and killing time, has now raised up a well-planned fabric to show how time is made, and the rate at which it is killed. In other words, Birmingham has commenced upon an extensive scale the construction of time-keepers.

The English Watch Company at Lozells is the latest fact that we have to record, and it is now fairly under way in mercantile waters; before, however, we enter within its gates, we will take a hurried glance at the past, and link it on to the present for the purpose of contrast and comparison.

The town of Birmingham has a much older reputation in the Craft of Tubal Cain than most persons suppose. To go no further back than 1538, in the time of "Bluff King Hal," Leland speaks of it thus:—"I came through as pretty streetes as ever I entered. This streete, I remember, is called Dirtey. In it dwell Smithes and Cutlers, and there is a brooke that divideth this streete from Bermingham * * * . There be many Smithes in the towne that used to make knives and all mannour of cuttinge tooles, and many lorimers that makes bittes, and a great many naylors." The good people of Deritend do not owe much to the sixteenth century traveller for the uncomplimentary fashion in which he spelt the name. The Historian Camden, however, in his *Brittania* followed Leland, and said that "Most of the inhabitants be Smithes," and and that he was agreeably surprised to find it "Swarming with inhabitants, and echoing with the noise of anvils."

When we come to consider all the metallic productions of this famous town, it seems marvellous that watchmaking was never established. Guns, swords, brass and bronze work, pin, pen and button-making, glass-work, electro-plate, and jewellery; the cradle of the steam engine, even the place where money itself is made—nay, has not Birmingham had an assay office for more than a century,—July 1773—and yet no watchmaking works! Its well-known "anchor," of all other devices as a Hall-mark for an inland town, has figured upon almost every imaginable article of gold and silver, except upon watch cases. That seems very singular, all other things considered, but it is true nevertheless. All that is now remedied, and if the new Company should turn its attention to chronometric navigation, the "anchor" of its assay would look a suitable emblem. At the time of the establishment of the Birmingham Hall-mark, the population of the whole county of Warwick barely exceeded 140,000 souls. Now, what a change. At the last Census the population of Birmingham alone numbered 344,787!

Arriving at the Company's premises, in Villa Street, we see no outward sign of a watch factory; but instead, a row of cottages, which, when Villa Street was in the country were doubtless considered "genteel;" these are now occupied by various foremen employed on the ground, and passing through the one that for the present does duty as offices, we find ourselves in front of what we have come to see. Looking above and before us we behold a newly-built brick structure, erected on part of the ample garden space in the rear, and occupying two sides of a square; all of it is three stories high. "And this," we exclaimed, "is the latest nest of the Nuremberg egg!" Perhaps it may not be generally known that "The ancient city of Nuremberg, so famous for the ingenuity as well as ability of its astronomers, has always laid claim to the merit of the invention of watches, or pocket-clocks, as they are called by the Germans; and the fact of the early watches having been called proverbially Nuremberg eggs, seems to favour their claim. It is certainly the earliest place at which we have any authentic information of their having been made, and we have also the name of the artist who first made them." And this artist was one Peter Hele, who made his first watches soon after the year 1500. They were egg shaped, hence the name Nuremberg eggs. The watch of Oliver Cromwell, worn between 1625 and 1658, was of that shape. On the other hand, John Milton's watch, made by William Banting, London, 1631, is comparatively flat and circular, with his name in the central part of the dial, and a month date on a circle outside the hours. Again, in *Twelfth Night*, Shakespeare makes Malvolio, when discounting in the garden his imaginary future greatness, say, "I frown the while; and, perchance wind up my watch, or play with some rich jewel." From Peter Hele to the English Watch Company, is a long stride in watchmaking, as our readers will discover before they have finished this paper.

The English Watch Company is based upon the idea that the introduction of high organization, machinery and a revised system of procedure in manufacture, are not only applicable to the English Lever Watch, but are manifestly indicated as necessities of the times we live in. The Company make going barrels only, working from a tapered mainspring, and lever movements with club-teeth escapement. They announce in a note of their trade circular which is before us, that their work is "Manufactured on the gauged and interchangeable system, and contains special mechanical arrangements, simpler and superior to any other English watch in the market." They also announce the escapement as "of the finest possible quality," the frame "of the best kind, known as hollow-back," whilst "the case, dial, and hands are of the best quality and style." From these statements a sketch notion of the character of their productions may be very fairly gathered. They make no fuzee movements at all, although they do not absolutely say they never intend to make any. Such being the case, their trade rivalry will, we judge, place them in competition with the English manufacturers who make for the million, rather than with the select few first class fuzee movement makers; indeed, so far as anything of that kind goes, there is room for all when it is known by the watch-wearing public that the action of both fuzee and going-barrel is sound and may be depended upon. Indeed, the advocates of the going-barrel do not hesitate to claim positive advantages for their system over the fuzee and chain arrangement.

We will now begin our rounds and explain what we see as we go on, but we beg to intimate that we do not tie ourselves to strict successional order, as each process will be understood without confusion by itself. Upon entering the factory, the first thing we saw—for we could hardly hear it, shade of Peter Hele!—was the engine. After casting a glance or two at it, we turned round and stepped beneath the shafting into the machine and tool making shop. Here were lathes of the newest contrivance at work; we were informed that all machinery, &c., from the movement and case-turning lathes and tools upwards were made in this shop, chucks, cutters, cramps, dies, in fact everything. We were shown, among many other articles in process of construction, an automatic screw-cutting machine upon a new principle, and so full of capabilities that its very extent of foretold perfection prevents our giving any details about it. In this shop also was a rolling "mill," on an improved plan. Its peculiarity consisted in this; that whatever the thickness of the metal passed between the rolls, the wheel-work always maintained the same gearing. This rolling-mill is used to supply gauge-metal for the movement and case work of other shops, and, as far as could be seen, it was fully up to its work.

Leaving the engineering shop, we are introduced to a large well-lighted apartment having lines of pully shafting overhead along each side of it. The shop is of width sufficient to conveniently accommodate four rows of benches, and upon these are the various machines and machine tools, driven by the shafting and strapwork already mentioned. We see a number of cleanly, healthful-looking young women and men directing the several operations entrusted to them. There is practically no noise; indeed such an atmosphere of quiet pervades the place that a lecture could very well be given on the economy of watchmaking by steam machinery, and could be heard by every one within sight. Wherever a machine watchmaking factory is run by such an arrangement of shafting as we have seen in our recent visit, repose and order are sure to be the rule; and it must be evident to any person who considers such surroundings for a moment, that the work thus produced will also bear upon it an impress of the producing circumstances.

In this shop we see the movement making in all its stages. Here strips of brass, of the requisite dimensions both in breadth and thickness, are placed under the die press and stamped out with great celerity. The blanks are then turned in a suitable lathe for a true surface; after which they are turned over and "faced" on the other side. Taking a pair of plates and following them, we find that the next operation is drilling for the pillar-holes and dial-feet. That being done, another operation taps the pillar holes to receive the screw ends of the pillars, whilst a different machine turns the pillars and taps them ready for insertion. The pillars, four of them, are completed and put into the plate in the short space of five minutes! The recess for the dial wheels was cut in half a minute, whilst another for the centre wheel, the sinking for the capeat and making the diameter true, were done with similar rapidity. The ratchet bar and scape bar occupy the attention of two machines, one doing the outside, the other the inside, and the two faces. We next come upon a machine that makes and screws in steady pins. We looked somewhat amazingly at the preparation of these same steady pins. A young woman has charge of the machine, and in "operating" it, as our American cousins would say, she first of all "taps" it the required distance, and then makes a nick in the wire so exact to what is wanted that the pin is snapped off at it with the same nicety. An adjoining machine tool forms all these pins to one gauge in length, and at the same time beautifully rounds their ends. These various processes may be counted by seconds, the same as many others. What surprised us was the invention, construction and employment of solid, strongly built machine tools for such apparently trivial purposes. "Good gracious!" we exclaimed, "to use such costly means to cut pin-wire and such like!" "Yes," was the rejoinder, "and if we did not use these machines the cutting of the pin wire and the such likes, as you please to call them, would cost about three times as much as they do. We want them by the thousand in this factory." After all the drilling has been done, the frame is fitted with cock, barrel-bar, and potance, each piece having been previously made to gauge; the side of the cock and barrel-bar is milled to fit to a nicety at the proper angle, and an ornamental cut is made at the opposite side of the cock; this plate then goes and is turned down for capping.

Next we come to that important part of watchmaking known as "centreing" or "drilling off." This drilling off, by the way, is a matter worthy of a little further attention. The number of holes to be pierced in an ordinary full plate lever watch, such as is now under review, is something over forty. They all require to be positioned with exactitude; but there are degrees of exactitude, and what is quite sufficient for one class of holes, the steady pin and screw-holes, for example, would be fraught with fatal error if applied to the pillar-holes or the train-holes. So it comes about that in this factory different methods are employed for different groups of piercings. The whole of the screw and steady pin holes in plates, bars, and cocks, are drilled direct from templates, with hardened steel "bouches" in the template holes, and a specially formed drill, a degree of accuracy amounting to actual interchangeability is attained. But still this is not close enough for the other piercings, where a slower but more precise method is in use. To drill the pillar holes we observed that the plate is powerfully cramped in a revolving table which is held in position during the drilling of each hole, and the most ingenious arrangements are devised to prevent metal dust finding its way into the machine during the operation, and so falsifying the result. Both the plates being drilled upon the same machine tool, absolute identity in position is secured. This mode of procedure, however, will not answer for the drilling off of various "depths" throughout the watch, for in that, after all, lies the very essence of endurance and regularity in a timekeeper. The old method, as is well known, is to pitch every separate wheel to its correct depth in its pinion, and then, having scribed it off on the plate, to proceed, with much care and many an element of error in the process, to drill off the first hole, the workman as a rule being only guided by his eye for the vertical line, and afterwards "upright" from that hole for the corresponding one. This, in the hands of practical operators, was generally safe, but never expeditious; still, it was inevitable, and until the era of uniform sizes of frames, wheels, pinions, pivots and escapements, upon which we have now entered, there was no escape from the tedious method just indicated.

Here, however, in a spacious office, divided by glazed partitions from the other portion of the large shop, and superintended by a remarkably intelligent workman, who, we were told, was, like many of the employés on the ground, brought up to some trade other than watchmaking, here, we say, we saw the latest developments of watchmaking machinery. The machine at this moment in our mind is, however, one designed to supersede the depthing tool just referred to, with all its delays and shortcomings. So far as a close scrutiny of its operation and principle at the time of our visit goes, we cannot see the slightest reason why it should not do all that the manager positively assured us from experience that it does, viz., drill off the entire series of train holes for the watch, and that to perfection. This has been partially attained elsewhere, as a reference to our July number will show, but the completeness with which the novel principle is here applied to the work to be done, really appears to leave nothing to be perfected. We were told that to drill off for the escapement, particularly the holes that give depth to the roller and 'scape-wheel, by machinery has been decided over and over again to be impossible. However, here was the machine at work, drilling away hole after hole, each one "dead" square, all guaranteed to be correct pitchings, and moreover, the work performed with a celerity which nothing but the most absolute confidence in the "truth" of the machine employed could justify. We are not exactly at liberty to describe the machine tool itself, but must confine ourselves to stating the fact that we saw the results produced by it, and were amazed and delighted. The room in which we now are, is a sort of sanctum, entered only by the privileged few who have special orders, and well it may be so, for it is the abode of the choicest inventions, the daintiest devices of the brains and hands of men who have set themselves to find a clear way through many a difficult mechanical problem. How well and how completely the "drilling off" is mastered we have just shown. It may be mentioned in passing, that this company makes *English* watches, and no small part of its special tools are devised to meet the likings of the English trade, and to give them a watch in all respects English in style and in all respects machine made. It so happens that the English watchmaker prefers, instead of the jewel end secured by a couple of screws, his potence with a dovetail jewel slip; now to cut by machinery the dovetail groove in the potence after the foot jewel hole is fitted in its place is another of the hitherto "impossible," because unattained, desires of the watchmaking world, yet here we saw a machine very complicated in appearance, but in reality based upon essentially simple principles, which before our eyes did just this—cut the dovetail groove in the potence and cut the dovetail slip, the latter fitting into the former with all the precision possible, and doing them both at one operation. To cut a dovetail and fit the jewel slip by hand is a brisk twenty minutes' work. We saw five so cut in a few minutes. There is a micrometer gauge used to detect variations in the height of the foot jewel hole, and we were told that although the cutters went within—well, say the thickness of a soap bubble of the jewel, they did not break one jewel hole in a thousand.

Leaving this mechanical elysium, we glance at other processes which with almost bewildering variety, but still in perfect order and with the quietude already referred to, are passing around us. Here a youth working a beautiful little slide rest lathe, with no end of novel appliances, is making pinion blanks; there a man is cutting them; at that elegant power cutting press the blanks of the various wheels, of the dial coppers and of many of the smaller parts of the movement are pierced, labour saving here as elsewhere being illustrated by an expenditure in tool-making which at first sight appears to be lavish. But it is very soon shown that if, for example, wheel blanks are pierced with the arms and edges already perfect they will want no "crossing," as the trimming up by file is called. So again, if dial coppers are cut out with the edge turned up, the seconds hole marked, and indents made to receive the feet, time is saved at a later stage and accuracy always ensured, and in like manner all through. At this moment we see steel ratchet blanks being with great rapidity stamped and pierced with the square hole at one blow out of a strip of steel. These blanks are threaded a couple of dozen at a time on a square bar, put into an automatic cutting machine, and away it goes without a moment's attention from living soul, until having cut all round it waits for a fresh supply. In like manner we saw regulators pressed, blocked or cramped, and in one of the numerous milling machines they are "milled," which simply means ground by hardened cutters into uniform shape twenty at a time. There is a busy screw-maker at work. How deftly he uses his lathe, bringing up first a gauge, then one cutter, another cutter, the die for tapping, and the final cut off tool in less time than we have been writing, whilst the slitting of the heads is done by wholesale, or at all events a regiment at a time, in another little "automaton" by his side. Here the lever is being made, the drilling off of the guard pin hole in a tiny jewelled template, the cutting of the notch, and the piercing of the slot which allows of angling, horological, not piscatorial, be it remembered, for the company prefer screwing to pinning up, all are processes requiring close attention and considerable skill, even when aided by the mechanical "helps" pertaining to each. One of the prettiest operations that we witnessed was making barrel arbors. The wire is first put into the lathe and turned to a fine gauge, it is next squared for the key, then tempered and the pivots turned down and polished. After this six are tightly screwed into a gauge plate and a steel cap put on the plate having openings to represent the depth of the actual watch case; it is then applied to a running lap, by which the ends of the squares are turned down to an almost superfluous exactitude, six, as we have said, being finished at a time Further on we see the turning and pivotting of the balance staff, which is perhaps the finest steam power turning in the world, certainly by far the minutest we have ever seen.

With a passing glance at the jewelling room, where, as almost everywhere else in this factory, traditions have been cast away and what are called "new fangled notions" have invaded and established themselves by shear force of merit, we come to a large shop where we find endshaking, motioning, polishing of various sorts, and some other minor processes going on. More novelties strike us here, but what we could not help particularly noticing was the admirable system of gauging in use. In one part of this shop sits a man through whose hands passes the whole of the watch material consumed, and it really appears as though nothing was taken for granted. Every wheel, pinion, pivot, and screw is gauged, and beyond the very narrow margin of variation within which interchange of parts can be ensured, all are rejected. More than that a record is kept of the essential measurements of the parts of each watch, so that means are at hand for ensuring a counterpart in case of a breakage.

But we must not linger here, and passing on we come at last in sight of something like watchmaking proper. Here in a clear 80 feet of shopping, free at last from shafting, straps, and pulleys, we see the realization of the fundamental idea, the combination of the multitudinous details wrought out in the two stories of shopping through which we have just passed. Here the wheels form their first acquaintance with their protecting frames; the escapement is tested and adjusted; the dial put on, the balance spring applied and so on, and after a brief visit to the gilding room, from which the dingy "gray" movement returns with a durable auriferous surface, the watch is finally put up and examined, and going into a glass room devoted to timing and regulating, it stays there a long or short time in proportion to its behaviour, never leaving until it is proved to be correct. It then comes into the office ready for the pocket of its future wearer.

In the manager's office, which is placed in the centre of this roomy shop, we notice many devices for time saving, such as ready communication by means of speaking tubes and "lifts" with the other shops and ingenious methods, by means of coloured tickets and cabalistic letters, of obtaining a picture, so to speak, of the work in hand, both as to quantity and kind. Here we would fain have pushed our investigations farther, but time and our natural bashfulness prevented.

Before visiting the case-making department we look in the room devoted to machines not in use. Here they are, scores of them, idle to-day, but, said our *cicerone*, "Come here next week and you will probably see several of these running, and the busy ones of to-day occupying the shelves."

We take only a brief glance at the case-making shops. We see the office where silver in various stages of manufacture is weighed in and out; the muffle, where meltings are of almost daily occurrence. Up a flight of steps, and we come to a shop marked "no admission." This is the case-making proper, where again specially invented lathe processes are carried on; up still another storey, and we see men fitting in the springs, jointing the cases and so on, and in another shop the polishing is in progress. Then we retrace our steps and again reach *terra firma* impressed with the conviction that a new era in the art of making timekeepers has dawned.

We cannot close our description of this interesting establishment without referring to an invention just patented by the Company, which consists of a new safety click designed to prevent the extreme tension to which the mainspring in a going barrel watch, without stop-work, is subject. This extreme tension gives the balance a violent action and disturbs the watch, besides the added risk of the mainspring breaking at such a moment, These dangers are now entirely obviated, and the necessity for stop-work, a most frequent cause of stoppage in watches, is done away with.

How gratified we are that English enterprise has with such commendable spirit gone into this branch of trade, it is only ordinary patriotism to avow. In the course of our perigrinations, as may be imagined, we attained a pretty comfortable degree of familiarity with the principals, and many matters of great interest were imparted to us. On many subjects, however, our lips must remain closed, as the English Watch Company have secrets, as indeed we find most manufacturers have. One thing, however, they could not succeed in concealing, and that was the evident care given to ventilation, warmth and sanitary arrangements generally for the health and comfort of the people employed on the ground. Thanking the principals for the facilities afforded, we terminated our first, but we hope not our last visit to the works of the English Watch Company.

BOOK NOTICE.

Lehrbuch der Uhrmacherkunst im Allgemeinen (price 15s.), by Alb Johann, of Aarau, Switzerland, the able contributor to the *Journal Suisse d'Horlogerie* and *Allgemeine's Journal der Uhrmacherkunst*, will shortly leave the press. Without neglecting theory, where any advantage may be derived from it, this work will be specially a "practical instructor" for the watchmaker. It will contain from forty to fifty well executed plates, which will no doubt greatly enhance its value. We only regret that its publication in German will limit its usefulness to those who are competent in that language. Subscriptions for this work are received by the author, at the office of the *Allgemeine's Journal der Uhrmacherkunst*, Naumburg, A/S.

CORRESPONDENCE.

SILVER DUTY.

To the Editor of The Watchmaker, Jeweller, and Silversmith.

Sir,—"We shall all be ruined!" I find this to be the honest conviction of many of our leading manufacturers, and of not a few retailers, with reference to the proposed abolition of the duty upon silver-plate.

During the last few weeks I have carefully studied the financial history of the country, as reported in the columns of the *Times* of the last half century.

During this period, as is well-known, taxes have been abolished in the case of more than 1200 different articles, in amount possibly exceeding fifty millions sterling. From the year 1861 to 1876, the reduction of taxation absolutely amounted to £30,837,689.

It is interesting, and let me hope instructive, to note that the same cry, "We shall all be ruined!" has been heard again and again during the last fifty years. "We shall all be ruined!" said the farmers. "We shall all be ruined!" said the glass manufacturers. "The echo caught faintly the sound as it fell." "We shall all be ruined!" said the paper makers. And now, when it is proposed to extend the benefit of freedom to the last, the only remaining taxed trade, we hear the old familiar cry, "We shall all be ruined!"

It is remarkable that one of Mr. Gladstone's latest utterances has reference to this very subject.

Addressing a party of Excursionists at Harwarden, he said, "Some time ago, I met a large manufacturer of paper, and asked how he was getting on. The answer was, 'Oh, right well.' You know the paper manufacturers generally said they would be ruined if the paper duty were repealed. However, this gentleman was not ruined, but, on the contrary, said he was getting on famously. I said 'You mean that you are doing more business,' and he replied 'Yes, we do more business, and get more profit.'"

Let me commend these words of the greatest financier the world has ever seen to my brethren of the Silver Trade: depend upon it, not ruin but increased business and increased profits to us all, will follow the repeal of the unjust and impolitic tax which now confines our trade within the narrowest possible limits.

In your next issue I hope to be permitted to make a few remarks upon the tax considered as "Obstructive to Art-progress, and an Insurmountable Obstacle to Technical Education in its Application to Silversmiths' Work."

I have the honour to be, Sir,
Your obedient servant,
Edward J. Watherston.

21, Pall Mall East, August 31st, 1877.

QUERIES AND REPLIES.

W. G. F. wants to know how to braze with brass, and use hard and silver solder with blowpipe.

A.—To braze with hard or silver solder, file the metal clean and smooth where the intended union is to be, bring them in close contact, apply the solder in small pieces and fuse, using borax as a flux.

P. R. asks how to plate small brass articles with silver without a battery.

A.—A cheap method of silvering is to mix one part of chloride of silver with three parts pearlash, 1½ common salt, and one part whiting. Clean the articles well and apply the plating mixture by rubbing it with a cork or a roll of soft leather. When silvered, wash thoroughly and wipe dry.

G. S. says: "I cannot succeed in covering Smee battery plates (silver) with an equal coat of black oxide of platinum. I tried several ways, but fail to get an equal colour. Also, whether the platinum coating must be very dark, or if a greyish-looking coat is sufficient?"

A.—Dissolve chloride of platinum in about 100 parts of cold water. In this immerse the silver plate and connect it by means of a wire with the zinc pole of a small battery. Then connect the positive pole of a battery with a small rod of clean carbon, also immersed in the platinum solution. Or a small porous cup, containing a rod of zinc and water very slightly acidulated with muriatic acid, may be used in place of the carbon anode; then, on joining the zinc and silver with a copper wire, the platinum will be deposited on the silver as a black or greyish-black rough coating. The silver plate must be perfectly clean to secure a good deposit.

J. asks:—"Can you inform me how to *frieze* silver jewellery and any article that is gilt or plated?

Ignoramus says:—"I should be very much obliged, if any of your numerous correspondents would inform me how to regulate a pedometer, to a man's stride, or the stride to the pedometer, so as to indicate the walking distance?"

OLD ENGLISH GOLDSMITHS.

One of the most prominent places for gold-work in the sixteenth century appears to have been Norwich, and among the Goldsmiths of that town particular mention is made of Peter Peterson, whose productions enjoyed great renown in the reign of Queen Elizabeth. The Corporation of the town still possess many pieces of gold, manufactured about this period, of which perhaps the most interesting is a bowl of silver gilt, supported by a very short foot, bearing in full the signature of Peterson; two other cups of the same description; a mace for the chamberlain, which was presented to the city by Elizabeth; a very fine ewer and basin, manufactured in London in 1595, and many other objects of a later date.

The mace, which is principally composed of pieces of crystal, inlayed in elaborate settings of rich chasing and precious stones, is surmounted by the regal crown, with the globe and cross. It is also ornamented with shields of the arms of Edward VI. and Elizabeth, the whole being supported by bosses of lions and dragons.

The ewer is also remarkable for its workmanship. It is entirely executed in *repousse*, representing in groups all the demi-gods of the ocean, tritons, nymphs, little cupids riding on dolphins; on the top are the winds symbolized by cherubs with inflated cheeks, and at the back by marine monsters. The handle is a half length of a woman, supported by a dragon.

The basin is of the same nature, the principal embellishment being the triumph of Neptune and Amphitrite, with their usual attendants. Pretty little cupids playing with marine monsters complete this truly Pagan decoration, among which, by a singular misappropriateness, some one has inserted a medallion, representing Jesus washing the feet of His disciples. Another ewer of the same date, and which has great similarity with the above, belongs to the Corporation of Bristol; and a third, also made in England about the middle of the sixteenth century, is now the property of the Duke of Rutland, and is, if possible, more elaborate in design and execution.

The College of Corpus Christi in Oxford, has several pieces of gold plate, which were given to it by its founder, Bishop Fox, at the beginning of the sixteenth century. These would be well worthy the inspection of our modern artists. There are also some curious pieces of workmanship at the college of the same name at Cambridge. The Mercer's Company, among other valuables, possess a singular piece of gold work; it is a chariot with four wheels in silver gilt, on which are grouped several persons, supporting a small barrel to contain wine, the whole surrounded with enamelled arabesques, and made to move by some ingenious mechanism. Indeed, it may be added that most of the City Companies possess, among other productions, interesting specimens of English workmanship of distant times. And so do also some of our provincial towns; among others we might specially cite, Bristol, York, Doncaster, &c. Numerous examples of the curious reliques of our native excellency are to be found among the members of our aristocracy, perhaps few excelling in value or importance the collections of Her Majesty, Baron Lionel de Rothschild, Mr. Hope, those of Lord Spencer, formally the celebrated Duke of Marlborough, and which were given to him by Queen Anne. Many others might be cited, but chiefly we must not forget the numerous opportunities now offered for the advantage of our manufacturers, by the establishment of the National Collection at South Kensington. There they can see beauties to be imitated, and errors to be avoided, for in truth it must be admitted, that howsoever much these earlier specimens of Art excelled in richness of materials, and gorgeousness of workmanship, they could not approach the taste and style of their contemporary workmen of the times of Louis XIV. and XV. It was, perhaps, only through the influence of such men as Flaxman and others of his class, that English workmanship has attained that superiority of character which it now possesses.

A Devil of a Watch.—Aubrey tells us the following story of a Mr. Allen, a reputed sorcerer, who died in 1630: "One term, being at Homer Lacy, in Hertfordshire, he happened to leave his watch in the chamber window. Watches were then rarities. The maids came up to make the bed, and hearing a thing in a case cry, Tick, tick, tick! presently concluded that that was the devil (Allen's supposed familiar), and took it by the string with the tongs and threw it out of the window into the moat, as they said, 'To drown the devil!' It so happened that the string hung on a sprig of elder that grew out of the moat, and this confirmed them that it *was* the devil. So the good old gentleman got his watch again."

VOLTAIRE, A WATCHMAKER.

Lost between the Alps and the Jura, lies the little country of Gex, now impoverished and unpeopled by the effects of the revocation of the Edict of Mantes, but which, under the energetic impulse of Voltaire, became the centre of an industry full of activity and very prosperous.

The little city of Feruay may be said to have been created by him. From having been an insignificant hamlet, he transformed it to a small elegant town as full of animation and activity as a hive of bees. Thus he could say truly in his letters: "I have built houses for the cultivators of the land, I have put abundance where heretofore was misery. I have succeeded in making of a miserable and unknown hamlet, a really pretty city, and in establishing a trade (watchmaking) which extends itself to America, Africa, and to Asia. In fact, three-fourths of the houses were constructed by him, and of them a traveller writes: "The least handsome of any was of more worth, and indeed was handsomer than the most superb of those in the villages round about Paris."

When he wrote to Madame Neckar, "You did not know what was reserved for the little district of Gex. It will become, thanks to M. de Choiseul, one of the most flourishing in Europe, and all the land will double in value in the course of a few years"; it is not the name of M. de Choiseul that he should have used, but his own; for it required all the power and all the goodwill of this remarkable man, to triumph over the bad fiscal laws and the detestable government of his time. An army of Alguazils, "enemies of the human race," to use his own expression, did not cease their endeavours to shackle the advancement of its lands and its manufactures. Voltaire, however, feared not, in the interest of his country, to solicit, to sue incessantly, to demand, justice or favour, from ministers or from good men whom he endeavoured to make co-operators with himself in his work. "We are ourselves," writes he, "but of little account, but we work, we seek to bring money into the kingdom, to attract strangers; we increase in numbers, and we ask no other help than the liberty of being useful."

He displayed great zeal, and the most admirable devotion in advancing the special industry which he had founded at Fernay; and as he says, "It is singular that almost all the watchmakers whom I have established here work for the watchmakers at Paris, who audaciously put their names on watches which have been made by us (*qui se font chez moi*). We make watches here far better than at Geneva, and M. Lepine, watchmaker to the king, one of the most skilful in Europe, has his establishment and his workmen here. On the one hand, we work for Paris; and on the other, for Bengal. The English prefer us over the London workmen, because we manufacture half as cheap again. Repeating watches, which cost more than thirty louis at Paris, can be had at Fernay, as many as you wish, for eighteen. Give me then your orders, you shall be attended to; you will have very handsome watches, and very bad verses, whenever you please to ask for them."

At the death of Voltaire, the harsh and oppressive laws reasserted themselves, also the army of Alguazils, "enemies of the human race," who fattened on these abuses. The industrious and flourishing colony which had promised to be a source of prosperity to the whole department, and which employed about two thousand watchmakers, rapidly succumbed. The Revolution gave it its last blow, and the whole industrial commerce disappeared.

Mon. Henri Robert's Mysterious Clocks.—The mysterious clocks of the above ingenious clock and chronometer manufacturer have of late attracted a great deal of attention; but no complete description of these clever productions of horological art had appeared till the publication of a special report read before the Société d'Encouragement Pour l'Industrie Nationale, in the name of the Committee of Mechanical Arts. We shall present our readers in our next with a minute and illustrated description.

Australian Sovereigns.—In the last twenty-one years the Sydney Mint has coined and issued more than 37,000,000 sovereigns; and the Melbourne Mint has coined and issued nearly 7,000,000 sovereigns since it was opened to the public in 1872. These two branch Mints together coined and issued in 1876 as many as 3,737,000 sovereigns, which is a larger number than the sovereigns coined in the year at the Mint in London.

Imports of Clocks.—The number of clocks imported during the year 1876 was 601,014, representing in valued £447,157. During the preceding year the number was 518,466, valued at £405,150.

THE WATCH CONTROVERSY.

(From the *Jewellers' Circular*, New York.)

Mr. Editor: We have read in the *Courier Suisse* of April 22, a letter which Mr. Favre-Perret, late Swiss Commissioner to the Exhibition, and member of the jury on watches, has addressed to those newspapers of this country which published the speech he delivered at La Chaux de Fonds last November, and we shall be glad if you will give us space to notice such portions of it as seem to require comment from us. It is true our Company is not particularly referred to in the letter, but we may suppose we are included amongst the watchmaking Americans whom he now finds it necessary to disparage. He paid us, in his speech, so many compliments, he was so generous in the language of eulogy of our factory and its products, his praise was apparently so sincere, and was calculated to do us so much good now and hereafter, that we really cannot, without a word of objection, allow him to take it all back, and say he didn't mean it, and that he intended only to compliment us on our superior skill in making "four dollar watches."

Before we proceed further, however, we may notice, in defence of whom it may concern, the charge of inaccuracy in the translation of his speech. Mr. Favre is able to specify but a single such instance, but over that he is very severe indeed. The charge in effect is (without quoting the whole paragraph) that he was made to say *positively* that under certain circumstances the Swiss would be driven out of the American market, whereas he asserts his statement was *conditional.* We have no copy of the original French by which to verify what he says; but, assuming such a mistake was made in rendering an unimportant remark, it is reduced to a matter of very small consequence by the fact that in another part of his speech, in another connection, he said, word for word, without any *ifs*, "Nor must we leave out of sight the exorbitant customs, duties and freight, which amount to about 25 or 30 per cent., which take away from us every possibility of being able to stand the fight." Further on he remarked, "We must make up our minds to lose the American market." The translator's blunder was hardly so great as his own in calling attention to it. The speech was in fact translated, so far as we know, with extreme fidelity, although perhaps the word "soignées" should not have been rendered "complicated." But there is some excuse for the translator. He could not have imagined Mr. Favre really meant to assert that his countrymen were beyond competition in fine watches of *ordinary calliper.* For Mr. Favre had held up to his audience a watch of our *fifth grade* (the movement of which cost him about $16), and, after recounting its remarkable performance for an unadjusted watch, quoted with approval the opinion of his examiner ("one of our finest adjusters"), who took it apart for a thorough professional inspection, "that one would not find one such watch in 50,000 of Swiss manufacture." If Mr. Favre would say this of our fifth grade, could it be possible he would deny such a quality of excellence to our fourth, our third, our second, and our first qualities as would rank them with the finest of the Swiss? And here, perhaps, we may be allowed to ask a conundrum: If not one Swiss watch in 50,000 could be found equal in quality to our fifth grade, how many could be discovered for competition with the qualities above it?

Mr. Favre asserts, as strongly as if he knew no better, that the great advantage of machinery is felt in the making of four dollar watches, and insinuates that we finish all our better goods by hand. The case is just the reverse of this. Our finishing machinery is as elaborate and extensive as the forming tools, and we depend as absolutely upon it. It is this which takes the place of the "real watchmakers" about whom he is so eloquent. It saves in fact the most expensive kind of labour—that of those very men. Take for example the pinions we use in the better grades which are finished to the last touch by machinery. We assert for them that nothing in the form of a pinion can be produced by any process, manual or mechanical, which is more highly and truly finished. Machine finish is best because *it is truest* and preserves the shape of the piece, which is the one essential and paramount requisite. It is this very machine finish which makes in part the superiority of our goods. We do not spoil what has been properly formed. The Swiss and English will never understand this; and they go on year after year laboriously polishing by hand their pieces out of shape in the fond delusion they are making good watches because they are highly finished. The truth is, the "four dollar movements," as Mr. Favre calls them, are made as it were by accident. They are composed chiefly of the refuse material culled out for slight imperfections—too good to be thrown away, but not good enough to be sold with our guaranty. It surprises us to see how highly they are appreciated in Switzerland. It is true they are excellent timekeepers (it is difficult on our plan to help that), and are really very good compared with much that is imported, but for ourselves, we are ashamed of them. And yet it is of these watches only Mr. Favre would now have us believe he was afraid, and for them sounded the rousing alarm which has been heard wherever newspapers go, round the world. Was it then really of this class of goods, which in our scale ranks tenth or lowest, and is only one-tenth of our production, or was it not rather of that dreadful fifth grade Mr. Favre was thinking when he uttered in his speech these dismal words: "I sincerely confess that I have doubted that competition. But now I have seen it—I have felt it, and am terrified by the danger to which our industry is exposed," and when he exclaimed, "Had the Philadelphia Exhibition taken place five years later, we should have been totally annihilated without knowing where or how we received the terrible blow. We believed ourselves masters of the situation when we really have been on a volcano.

Nobody knows better than Mr. Favre that the advantage of our system is felt throughout all the grades; and that as respects essential timekeeping quality, which is all a watch is good for, we give more value, at any given price in the whole range, than do his countrymen. He found it out when he was here, and was understood to acknowledge it, in his speech, when he told the story of the fifth grade watch, and added, "you understand from this example the American watch may be preferred to the Swiss." That the great bulk of the Swiss watches made by those 40,000 "real watchmakers" has not been *good*, however "highly finished," is absolutely undeniable. Mr. Favre admitted it over and over again in his speech. His own statistics attested that this country at least rejects them; and he wound up his remarks by saying, "it remains for us to profit by this sad experience and to *improve our manufacture.*"

With all this in mind, the public cannot be expected to believe Mr. Favre when, under the pressure of the "storm and tempest" which he says were howling about his head, he now writes, "We succeed in giving the consumer, for the same price, if not a lower one, a watch better made, more finely constructed, more elegant, and giving better results of running than the American watch." Our people are somewhat credulous, and somewhat accustomed to the somersaults of public men, but the above is rather too much even for them. They, with ourselves, will prefer to believe what Mr. Favre said in his speech when he was fresh from the Exhibition and from the factory, and with perfect frankness told his surprising and disagreeable story, under no alarms, except such as he felt as a patriot and a manufacturer in view of the loss of business. *Then* he spoke the truth; for he believed the lesson which had been taught him that the American public were tired of fine watches, and now demanded and were getting good ones. He had not then forgotten that the day of sham and outside appearance (in watches at least) has gone by in this country at all events, and that our busy and practical folks *will have the time of day whenever they look for it.*

There is nothing else in Mr. Favre's letter which we care to notice except the attempt he makes to belittle the trial which was made at Philadelphia, of the running of our adjusted watches. We admit it was brief and imperfect; but, considering that the daily thermometer averaged, during their trial, 95°, that they were carried about from one place to another while observations were going on, and were suffered to run down once between observations, the results were very remarkable. Contrary to Mr. Favre's statement, we did not expect or prepare for any trial at all. The watches we offered for competition, if any competition should be allowed, were the only ten we had on hand of best quality; and their adjustments, so far from having been a long time in progress and complete for the trial, were not even complete in the ordinary course of preparation for market. Whether the performance was good as compared with the record of the best Swiss watches exhibited, according to the certificates from the Swiss observatories, we were not allowed to know, for Mr. Favre objected on the part of his countrymen, to any comparison being made, for the reason that the trial was too *short*, and not sufficiently varied. We contented ourselves, therefore, with a comparison with Swiss watches of previous years. But we determined that a trial to which no such objection could be made should be had, and obtained Prof. Watson's consent to give them precisely such a series of tests at his observatory, Ann Arbor, Mich., as that prescribed at Neuchatel. Prof. Watson's observations lasted nineteen weeks, and he has prepared several tables, showing the results, which will be incorporated in his forthcoming "Report on Horology at the Exhibition." By permission of the Centennial Commission, we shall shortly publish, in pamphlet form, these tables, and his remarks upon our exhibit. Meantime, we are at liberty to quote from them the following passage as our best reply to this portion of Mr. Favre's letter, as well as to the whole remarkable performance itself, a performance which, as an attempt on the part of a man who has turned himself inside out *to get back in again*, makes an instructive moral show, not unworthy of the Great Exhibition itself.

"It would be of benefit to the Company if their finest productions could be subjected to trial every year in some astronomical observatory. Nothing has done more to stimulate the Swiss manufacture toward excellent workmanship, and the most careful adjustments possible, than the competitive trials which have been made for a series of years at the Observatories at Neuchatel and Geneva. In this way, by comparison of results, can some idea be formed of the progress made and the degree of perfection attained. The trials of the first-class pocket chronometers, at the Swiss observatories, extend over a period of six weeks. They are tried in five positions and in the oven. The second grade of pocket chronometers are subjected to trial for four weeks, in two positions, hanging and lying, and in the oven. It will be seen by reference to the parts of this report which refer to English, Swiss, and German exhibits, that the labours of the judges were very much facilitated by the certificates issued from the observatories, showing the results of the actual trials of the adjusted movements which were on exhibition. And in a determination of the progress which has been made in America, there was thus provided a standard of acknowledged excellence. It is not the purpose of this report to make direct comparisons of the productions of different manufacturers. The reader who is curious in such matters will find, in most cases, the requisite data under the heads of the report relating to the exhibits in question. But in order to convey to the general reader an idea of what the system of manufacture under consideration has made possible in a newly developed industry in this country, it is proper to state here that the reporter has compared the results of the trials as heretofore given with those furnished for all the first-class fully adjusted watches in the International Exhibition, and that it is clear beyond question that the chronometers numbered 670044, 670082 and 670095 [Waltham watches] are altogether superior to any others exhibited. The tables already given show clearly the excellence of their adjustments, and the smallness of the mean daily variation of their rates. The best of these, taking everything into account, is No. 670044, for which the mean daily rate was only thirty-eight one-hundredths of a second, and for which the difference of mean daily rate between the first and eleventh weeks of the trial was only one-hundredth of a second. The steadiness of the rates of these watches is best shown by placing in juxtaposition the average daily rate during several weeks separated by considerable intervals, and during which the determining conditions were very different as already stated. The following are the results:—

Week Ending		Mean daily rate of No. 670044	No. 670095	No. 670028
		s.	s.	s.
1876.	July 20	—0.50	—3.60	—2.80
	Sept. 18	—0.63	—2.95	—1.87
	Oct. 30	—0.72	—3.13	—1.77
	Nov. 26	—0.66	—2.84	—3.07

These numbers for the sake of comparison, are reduced as nearly as possible to the temperature of 60° Fahrenheit.

The performance of No. 670044 is extraordinary, considering the vicissitudes to which it was subjected and the long period of nineteen weeks during which its rate is considered. The mean daily variation of the rate is greater than that of each of the other two, but this may be due to the imperfect elimination of the error of the eccentricity of the second's dial, in the daily comparisons. Its temperature correction is also apparently somewhat larger, but that all the essentials for good performance were present, is best attested by the steadiness of the rate from week to week as it was under trial.

No. 670089 is hardly of inferior rank to the three here specially mentioned, although the sum of its position errors is greater than the general average. * * * * *

The fullness of this report on this particular exhibit has been made necessary on account of the disposition manifested by certain foreign manufacturers to arrogate to themselves and their country the sole possession of that knowledge and skill which can render possible the higher achievements of horological art. While conceding, as they have been compelled to do, by the inexorable logic of the facts before them and the world, the superiority of the American system of manufacture in the case of all but the specially adjusted watches, they have been disposed to cling to the latter as of their exclusive control, and to look with suspicion upon any results which went to show the possibility of excellent production in these higher grades also. The final adjustment of a watch for position, for isochronism, and for temperature, requires only that the maker shall be able to produce the best quality of springs, of the desired form, and to make a balance of proper proportions, it being supposed that the escapement and the train have been properly constructed. The adjuster must understand the methods of springing, must know how to secure the poise of the balance, and how to modify the acting part of the spring so as to secure isochronal action in different positions and at different temperatures. It cannot be supposed that the science and skill which have achieved wonders in all of what might be call the inferior operations, should find an insurmountable barrier here. The results of the trials of the very few watches selected for that purpose, from among those of the exhibit under consideration, show that such is not the case. And the manufacturers may claim superiority for their finest productions, for the very simple reason that the machine to be adjusted finally for all the errors which interfere with accurate timekeeping, is a better machine when constructed upon their system than when constructed upon the old system, and the better machine being equally well adjusted with the inferior one, in respect to these isochronal functions, must, in the nature of things, be of a perfection more enduring, and must satisfy better all the conditions for the highest productions of horological art."

Ceramic Jewellery.—By the invention of Mr. W. H. Goss, of Stoke-on-Trent, an attractive kind of jewellery is produced, imitation or real gems being imbedded in delicate porcelain. Brooches, earrings, bracelets, necklets, the heads of scarf pins, charms, are *inter multis aliis* articles of jewellery which lend themselves specially well to the novel treatment indicated. Very beautiful floral brooches and crosses are produced, some being in fine white bisque, others tinted in the natural colours of the flowers represented, and others again in ivory porcelain, prepared by a patented process.—*British Trade Journal.*

The Clock of Jena.—This clock, which was made in the fifteenth century, is still in existence, and is of famous notoriety. Above the dial is a bronze head, presumed to represent a buffoon of Ernest, Elector of Saxony, who died in 1486. When the hour is about to strike, the head, which is so remarkably ugly as to have given the clock the name of "the monstrous head," opens its very large mouth; a figure representing an old pilgrim, offers it a gold apple at the end of a stick, but just when poor Hans (so was the fool called) is about to close his mouth to swallow the apple, the pilgrim suddenly withdraws it. On the left of the head is an angel singing (the arms of Jena), holding in his hand a book, which he raises towards his eyes, whenever the hours strike, and with the other he rings a hand bell. Should any of our readers visit this locality, the clock would be well worthy their inspection.

International Exhibition in Cape Town.—The following firms are amongst the list of successful exhibitors at the above exhibition:—

Max Tuteur, London, jewellery—Gold Medal.
Castelberg, Petitpiecu, & Co., London, watches—Silver Medal.
F. Conchon, Geneva musical boxes—Silver Medal.
Guichard & Co., Paris, barometers—Silver Medal.
Heath & Thomas, Birmingham, jewellery—Silver Medal.
T. O. Schuler, London, jewellery—Silver Medal.

Russian Gold and Silver Production.—The following statistics of the yield of the Russian gold fields for the year 1876 show that this source of wealth is considerable in that cold northern clime. The amount of gold mined in 1876 was 1,617 pouds, equal to 71,503 lbs. troy, having a value of 22,086,662 roubles. The silver amounted to 156 pouds, or 5616 lbs. avoirdupois, worth 142,360 roubles.

Prices Current for Gold and Silver—Value Given for Old Gold and Silver by Assay. Fine Gold, 84s. per oz. Fine Silver, 4s. 8d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3 d. per oz. Fine Silver, 5s. 3d. per oz. Standard Silver, 4s. 8d. to 4s. 10d. (variable.)

THE

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AN INGENIOUS CLOCK.

THE firm of Messrs. Sloane & Co. have in operation a clock which, in addition to being a remarkable instrument, has an electrical attachment which renders it, for the purpose it is used, that of rating chronometers, as near perfection as can be. It is not expected that the clock itself can ever come into general use, in view of the fact that it costs about $1000, but a description of it is not on that account less interesting. It is called an astronomical clock, with mercurial compensating pendulum. Every time the pendulum vibrates, its lower point, made of platinum, passes through an insulated bulb of mercury, which alternately breaks and connects the circuit of a battery with a little sounder that taps the seconds. To this sounder is attached a little ratchet wheel with ten ratchets, and at each tap of the sounder the wheel moves one ratchet. At the tenth ratchet a platinum arm goes into a drop of mercury, making a circuit with another sounder, thus giving every tenth second a tap which, being louder than the other, is easily distinguishable. The ten second sounder is the invention of Mr. Sloane and Commodore Dimpfel and is now being introduced itno the Naval Observatory. It enables the operator at the first rating to rate the chronometer to half a second, and at succeeding ratings to reduce the computation of the error to an infinite fraction, and by it the operator can rate chronometers almost as fast as they are put before him. The convenience lies in the fact, that every tenth second being distinguishable by sound, the clock need not be watched. —*Baltimore American.*

The Albert medal of the Society of Arts awarded to Sir G. B Airy, K.C.B., and Astronomer-Royal "for eminent services rendered to Commerce by his researches in nautical astronomy, and in magnetism, and by his improvements in the application of the mariner's compass to the navigation of iron ships," was presented to him on July 7th, at the Marlborough House, by H.R.H. the Prince of Wales, President of the Society.—H. J.

Large Telescopes.—*The Scientific American* reports that Messrs. Clark & Son, of Cambridge, Mass., are making a telescope fifteen feet long, with an object glass of eleven inches in diameter, for the Government Observatory at Lisbon, to cost $6000, and be used for photographing the sun. Princeton College is having a $4000, one made with a nine inch glass for astronomical excursions, and talks of getting a much larger one. The Clarks are also to make a gigantic one for Yale College, but it will take several years' work and cost some $50,000; the flint for the object glass, which has already been bought in France, cost $6000.

PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

2928. John Frederick Bennet, of 5, Southampton Buildings, Holborn, in the county of Middlesex, for an invention of "Improvements in studs or solitaires, applicable for other fastening purposes."—Dated 31st July, 1877.

3137. Henry William Ley, of Bear Street, in the county of Middlesex, for an invention of "Improvements in clocks."—Dated 17th August, 1877.

3223. Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for an invention of "Improvements in decolourizing and colouring pearls."—A communication to him from abroad by Joseph Marie Clement, of Paris, France.—Dated 24th August, 1877.

Grants of Provisional Protection for Six Months.

2720. To George Lund, of the firm of Lund and Blockley, of 42, Pall Mall, in the city of Westminster, Manufacturers, for the invention of "Improvements in apparatus for synchronizing or setting clocks or other time-keepers."

2850. To Peter Lawson, of Hatton Garden, in the county of Middlesex, for the invention of "Improvements in the construction of solitaires studs, and buttons.

2079. To John George Henry Hoch, of 283, Brixton Road, in the county of Surrey, Watch and Clock Manufacturer, and Carl Johann Heinrich Friederich Dagobert Obach, of 314, Brixton Road, in the county aforesaid, Picture Dealer and Print Seller, for the invention of "An improved system of day and night watches based upon the principle of a twenty-four hours division of time."

2505. To Frederick Eade & John William Blake, both of Birmingham, in the county of Warwick, for the invention of "Certain Improvements in the manufacture of plated edge seals, keys, and spring keys, medals, and edged charms, and other similar articles."

2928. To John Frederick Bennet, of 5, Southampton Buildings, Holborn, in the county of Middlesex, for the invention of "Improvements in studs or solitaires, applicable for other fastening purposes."

Patents Sealed.

530. William Robert Lake, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, for an invention of "Improvements relating to the working, regulating, and winding-up of clocks, chiefly designed for controlling a series of clocks by pneumatic power."—A communication to him from abroad by Victor Popp, Ernest Resch, and Charles Albert Mayrhofer as representatives of the "Gesellschaft zum Betriebe Pneumatischer Uhren," of Vienna, Austria.—Dated 7th February, 1877.

496. Francis Herbert Wenham, of 8, Oxford Road, Ealing, in the county of Middlesex, Engineer, for an invention of "An improved object stage for microscopes."—Dated 6th February, 1877.—[Time extended to 14th August, 1877.]

1976. Maurice Nelson, in the name of Veit & Nelson, of 11, Rue Bergère, in the city of Paris, Merchants, and Henry Pic, of 12, Rue de Poiton, in the city of Paris, Manufacturer of Mourning Jewellery, for an invention of "Improvements in articles of mourning or finery and ornaments."—Dated 19th May, 1877.

2051. George Bower, of Saint Neots, in the county of Huntingdon, for an invention of "Improvements in the treatment of metallic surfaces so as to effect their protection from atmospheric and other influences."—Dated 26th May, 1877.

Patents which have become Void.

2596. John Compton Weeks Jefferys, of Tottenham Court Road, in the county of Middlesex, for an invention of "An improved fastening for jewellery and articles of dress."—Dated 24th July, 1874.

2161. Frederick Mantell Pratt, of Holly Cross, Wargrave, Berkshire, Engineer, for an invention of "Improvements in tell-tale clocks."—Dated 3rd of August, 1870.

2780. Barnet Solomon Cohen, of 24, Great Prescot Street, Goodman's Fields, in the county of Middlesex, for an invention of "Improvements in the manufacture of artificial ivory."—Dated 12th August, 1874.

Patents Granted in Foreign States.

United States of America.

186,202. Charles H. Field, of Providence, R.I., for "Shirt-studs."—Application filed 5th July, 1876.

186,598. N. Meyers, of Buffalo, N.Y., assignor of one-half of his right to J. P. Braner, of the same place, for "Watch-escapements."—Application filed 9th August, 1876.

186,838. J. R. Hopkins, of Washington, D.C., assignor to Wm. B. Fowle, of Auburndale, Mass., for "Watches."—Application filed 12th January, 1876.

187, 305. Ami L. Junod-Pattus, of Sainte Croix Switzerland, for "Repeating watches."—Application filed 15th August, 1876.

186,987. F. E. Capron, of Providence, R.I., for "Cuff-buttons, studs," &c.—Application filed 4th December, 1876.

187,031. D. Mersereau, of Newark, N.J., for "Burglar-alarms."—Application filed 30th September, 1876.

187,055. W. W. Sherar, of Rochester, N.Y., for "Electro-magnetic attachments for time-locks."--Application filed 7th October, 1876.

187,180. Edward Schlegel & W. Schlegel, of Boston, Mass., for "Watch-glasses."—Application filed 22nd October, 1875.

7489. A. Hermann & W. H. Taylor, of Stamford, Conn., assignors, by mesne assignments, to the Yale Lock Manufacturing Company, of the same place, for "Anodes for electroplating with nickle."—Patent No. 166,367, dated 3rd August, 1875.—Application filed 5th May, 1876.

Prussia.

40. V. Popp, E. Resch, & C. A. Mayrhofer, of Vienna, for "A pneumatic connection between clocks."—3 years.—Dated 12th June, 1877.

57. T. Weisser, of Villingen, for "A self-regulating calendar-clock."—3 years.—Dated 15th June, 1877.

107. J. P. Brauers, of Aix-la-Chapelle, for "Two ratchet apparatus for musical boxes."—3 years.—Dated 21st June, 1877.

171. R. Stäckel, of Berlin, for "A mode of fixing escapements of watches and pendulum clocks."—3 years.—Dated 28th June, 1877.

198. C. W. Heuser, of Elberfeld, for "A timepiece."—3 years.—Dated 29th June, 1877.

Notices to Proceed.

2770. Alexander MacMillan, of the city of London, Manufacturer, has given notice in respect of the invention of "Improvements in solitaires, studs, and other fastenings."

1548. John Unwin, of Sheffield, in the county of York, Manufacturer, and Merchant, has given notice in respect of the invention of "Improvements in the preparation and preservation of an electro-depositing solution of nickel."

1579. Johann Anton Benedict von Castelberg, of 58, Holborn Viaduct, in the city of London, has given notice in respect of the invention of "Improvements in calendar watches."—A communication to him from abroad by Fritz Petitpierre, of Chaux de fonds, Switzerland.

1705. Charles Hénard, Manufacturer, and Etienne Lasnier, both of 1, Rue Laffitte, Paris, France, have given notice in respect of the invention of "A new cosmographic clock."

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Isaacs, Saml., 313, Icknield-street, West, Birmingham, jeweller, August 4. Webster & Graham, sols., 27, Colmore-road, Birmingham.

Langman, William Henry, Derwent-street, Derby, jeweller, August 1. W. B. Hextall, sol., Derby.

Leapman, Priscilla, Hastings, jewellery dealer. C. Lamb, sol., Brighton.

Collyer, Osman Henry, trading as Collyer Bros., High-street, Glastonbury, watchmaker, August 8. W. Plummer, sol., Bristol.

Etches, Enoch, 165, Great Ancoats-street, Manchester, watchmaker and jeweller. August 9. Horner & Son, sols., 3, Clarence-street, Manchester.

Frohwein, Jacob Otto, 93, Queen-street, and Havant-street, Portsea, jeweller. August 14. T. A. Allingham, sol., 55, Old Broad-street, London.

Slack, Uriah, Chesterfield, jeweller. S. E. Swaffield, sol., Chesterfield.

Ann Robert Henry,& Alfred Edward Ann, 65, Vittoria-street, Birmingham, jewellers and manufacturers. Aug. 21. F. M. Burton, and Reece & Harris, New-street, both Birmingham, sols.

Ann, Alfred Edward, 65, Vittoria-street and 5, Exchange-buildings, Birmingham, and Soho rd., Handsworth, jeweller (separate creditors). Aug. 22. Reece & Harris, sols., 47, New-street Birmingham.

Ann, Robert Henry, 65, Vittoria-street, Birmingham, & 3, Church-view, Westminster-road, Handsworth, jeweller and manufacturer (separate creditors). Aug. 21. F. M. Burton, sol, Union-passage, Birmingham.

Bowen, Arthur Owen, Station-street, Saltburn-by-the-Sea, jeweller. Aug. 18. T. H. Ward, sol., Middlesborough.

Reed, Alfred, 5, St. Andrew's-street, Cambridge, jeweller. Aug. 23. F. P. Adcock's, sol., Cambridge.

Rollason, Henry, 82, Vyse-street, Birmingham, jeweller. Aug. 24. J. E. Smith's, sol., 20, Temple-street, Birmingham.

Discharges Granted and Bankruptcies Closed.

Motta, John, Houghton-le-Spring, jeweller, &c. (Div. of 5s. has been paid.) Bankruptcy closed July 28.

Adjudications of Bankruptcy.

Langford, Edwin, Broad Quay, Bristol, watchmaker. July 31.

Dividends.

Nicholl, T. (Liq.), Camborne, jeweller. 1st and final div. 1s. 1d. and 1-12th of a 1d.; T. Chirgwin, River-street, Truro.

Morrison, Robert, Bridge-street, Inverness, watchmaker, &c. Equalizing and 2nd and final. T. Douglas, Town and County Bank, Inverness, forthwith.

Elliott, Charles A. (Liq.), 449, Strand, optician. 1st div. 2s. 6d.; any Wednesday between 11 and 2; J. Holab, 6, Moorgate-street.

Shirtcliffe, John, jun. (Bkt.), Sheffield, electro plate manufacturer, 1st div. 2s.; H. A. Styring, 185, Norfolk-street, Sheffield.

Trustees Appointed.

Atkinson, Thomas W., (Bkt.) Barrow and Dalton, jeweller. Tr., R. Ellis, Barrow, accountant.

Kipper, Frederick (Liq.), Bouverie-road, Stoke Newington, watch importer. Tr., W. L. C. Browne, 25, Old Jewry, accountant.

Lange, Christian (Liq.), 99, Strand, watch manufacturer. Tr., W. L. C. Browne, 25, Old Jewry, accountant.

Long, Joseph (Liq.), Regent-road, Salford, watchmaker. Tr., H. G. Nicholson, 100, King-street, Manchester, accountant.

Michael, James (Bkt.), Rattray-road, Brixton, jewellers-factor. Tr., L. J. Sharp, Ann-street, Birmingham, accountant.

Eginton, John L. (Liq.), Margate, watchmaker. Tr., W. C. Harvey, 1, Gresham-buildings, Basinghall-street, accountant.

Inwood, William (Liq.), Scotland-road and 31, Sackville-street, both Liverpool, jewellers. Tr., C. Conner, 57, Ranelagh-street, Liverpool, accountant.

Meek, John, Buchanan-street, Glasgow, dealer in clocks &c. Tr., J. Miller, 71, Queen-street, Glasgow. Com., W. Coghill, silversmith, T. Lawson, merchant, and J. Porter, jeweller, all Glasgow.

Langford, Edwin (Bkt.), Bristol, watchmaker. Tr., A. J. E. Williams, Bristol, accountant.

Swindells, John (Liq.), Stockport, jeweller. Tr., C. E. Kendal, 63, King-street, Manchester, accountant.

Dissolutions of Partnerships.

Alstons & Hallam, 31, Bishopsgate-street Within, gold and silversmiths. June 25. As regards Samuel Hallam.

Buxton & Martin, 177, Brompton-road, watchmakers. Debts by F. W. Buxton.

Cox, C. H. & Son, Northampton, watchmakers and jewellers. July 16.

Fenton, H. & C., 42, Spencer-street, Birmingham, electro gilders and gold cutters. July 6.

Lugg, Bros., Okehampton, Devon, watchmakers. July 14. Debts by Charles Lugg.

Peers & Neale, 50, Tenby-street, Birmingham, manufacturing jewellers. July 5. Debts by Lewis E. Neale.

Tarleton & Rowson, Exchange-street East, Liverpool, watchmakers and jewellers. June 30. Debts by Henry Rowson.

Meetings.

Walton, George Edwin, jun., trading as Walton and Walker (Bkt.), Birmingham, jeweller. At M. A. Fitter's, sol., 5, Bennett's hill, Birmingham, Sept. 10 at 12. Consider compn of 4s. 5d.

ON A WATCH.

See how the moments pass,
How swift they fly away,
In this instructive glass
Behold thy life decay.

Ah! waste not then thy time
In sin's pernicious road,
Redeem thy precious time,
Acquaint thyself with God.

And when this pulse shall cease,
And throbbing accents play,
Thy soul to realms of light
Shall wing its joyful way.

THE WATCHMAKER, JEWELLER, SILVERSMITH, AND KINDRED TRADES' DIRECTORY.

The important feature of our Directory Columns will be found to be a most effectual method of keeping the Names of Firms and Manufacturers before the constant notice of the Trade.

No Charge is made for Insertion of a Two-line Entry of Name and Address of Firms whose advertisements, occupying not less than one-third of a page, appear for twelve consecutive months. In other instances, the Charge for the Two-line Entry of Name and Address is £1 1s. per annum; four lines, £1 10s. per annum; six lines, £2 2s. per annum. No Charge is made for the heading or title under which any entry appears.

AMERICAN (WALTHAM) WATCHES.

FATTORINI & SONS (Wholesale Factors) Watch and Chronometer Manufacturers, Bradford, Yorkshire.

BAROMETER AND THERMOMETER MAKERS.

MURRAY & CALLIEU, 22, St. John's Square, E.C.

NEGRETTI & ZAMBRA, Holborn Viaduct, E.C.; Charterhouse Street, E.C.; 45. Cornhill. E.C.; 122. Regent St., W.

WEBSTER, J., 88, St. John Street Road, Clerkenwell, E.C.

BURGLAR AND FIRE PROOF SAFE MAKERS.

CHATWOOD'S, 120, Cannon Street, E.C., and Lancashire Safe and Lock Works, Bolton.

GEERING & TALBOT, Apollo Safe Works, Moseley Street, Birmingham.

PHILLIPS & SON, Speedwell Works, Sherborne Street, Birmingham.

THE SICKER SAFE AND STRONG ROOM COMPANY, LIMITED, Soho, near Birmingham.

WHITFIELD (F.) & CO. Whitfield's Patent Screw Bolt and other Safes, Viaduct Works, Oxford Street, Birmingham.

CLOCK IMPORTERS.

MAYER A. & SON, 122a, Aldersgate Street, London. E.C. Importers of American, French, Germsn, and Cuckoo Clocks, Materials, &c.

CLOCK MAKERS.

COHEN (JACOB) & CO.. 36 and 37, Ely Place, E.C.. and Charterhouse Street, E.C., London; and 10, Rue Béranger, Paris.

GILLET & BLAND, Steam Clock Factory. White Horse Road, Croydon. Exhibition Medal, 1873. Makers (to her Majesty's Government) of Worcester Cathedral Chimes at Bradford and Rochdale Town Halls, Boston, St. Stephen's Church, Hampstead, &c.; and of Clocks of every description; also patent Carillon Machines. Sole Proprietors and Makers of Patent No. 4141, for improvements in Church and other Bell Music. Established 1844.

GREENWOOD (JOHN) & SONS, Importers and Manufacturers of Clocks and Watches. Wholesale and for Exportation. Farringdon Road, near Clerkenwell Green, London, E.C.

GROOM, G., Windmill Road, Croydon, every description of Church, Turret, Railway, Chime, and House Clocks to the Trade,

SWINDEN & SONS, 27, 28 & 29, Temple Street, Birmingham.

DIAMOND MERCHANTS.

JONAS BROTHERS, 34, Ely Place, Holborn, London, E.C.

MARCUS (MAURICE) & CO., Waterloo House, Holborn Viaduct, London, E.C.

RUTHERFORD, JAMES, 2, Wilderness Row, E.C., and 33, Kirby Street, Hatton Garden, London, E.C.

WIEGEL, B., Jun., Diamond Merchant and Jeweller, 27. Wilmington Square, Clerkenwell. Diamonds and precious stones mounted or reset to the best advantage. Country Orders punctually attended to.

GILT JEWELLERS.

CARLOSS (W. J.) & KING, 66, Hatton Garden, London, E.C. Manufacturers of Gilt Head Ornaments, Coronets and Combs. Jewelled Gilt Table Ornaments, Flower Vases Inkstands, Prize Cups, and Ornamental Metsl Work.

HUTTON & CO., 5 and 6, Newgate Street, E.C., and Phœnix Court, Newgate Street, London, E.C.

JET ORNAMENT MANUFACTURERS.

BLUMBERG & CO., 2, Cannon Street, London, E.C.

JONES. A. EDWARD, 93, Hatton Garden, London, E.C.

LITTEN (T. R.), 64. Hatton Garden, London, E.C.

WILLIAMSON. HENRY, 85, Old Street, St. Luke's, London, E.C.

JEWELLER'S MATERIALS.

CLEMENTS, HANDLEY & Co., Dealers in all kinds of Tools and Materials, Stones. Pastes. Cases, &c., 19, St, John's Square, Clerkenwell, E.C. (*See* advertisement).

KING, J. W., Dealer in all kinds of Jeweller's Materials Stones, Pastes, Locket Glasses, &c., 15, St. John's Square, Clerkenwell, E C.

JEWELLER'S SHOP FITTERS AND SHOW CASE MAKERS.

JEFFREYS, CHARLES, 103, Hatton Garden, E.C. Estimates free.

SAGE, FREDERICK, Steam Works, Commercial Buildings, 80 to 84, Gray's Inn Road, W.C. Large stock on view.

JEWELLERY CASE MAKERS.

EDWARDS, JOHN, 26, St. John Street Road, London. E.C

JEFFREYS, CHARLES, Jewellery Case, and Velvet Stand Manufacturer. The largest stock in England. 103. Hatton Garden. E.C.

SAGE, FREDERICK. Steam Works, Commercial Buildings, 80 to 84, Gray's Inn Road, W.C. Large stock on view.

MANUFACTURING WHOLESALE JEWELLERS.

JOSEPH, B. H. & Co., 20. Frederick Street, Birmingham, Manufacturers of the Registered "Standard" Sizes for jewellers.

HUMPHREYS (JOHN A.). 23, Wilderness Row, Clerkenwell, E.C., Jewellery, Chains, Wedding Rings and Keepers, &c.

LAWSON (P.) & GODDARD (C. GILBERT), Manufacturing Goldsmiths, Wholesale Jewellers, Clock and Bronze Importers, Dealers in Precious Stones, and also English, American, and Geneva Watches, 5, Hatton Garden. London, E.C.

BASNETT, S., 29, Augusta Strest, Birmingham, Manufacturer of Coloured Gold. Jewellery, Sets, Brooches, Earrings, Pendants, Bracelets, Pins. Crosses, Slides, &c.

MYERS, N. A., 2, St. Patrick Square, Edinburgh, Importer of French, American, and German Clocks, Watches, Materials, &c.

MUSICAL BOXES.

GREENWOOD (JOHN) & SONS, Importers and Mannfacturers of Clocks and Watches. Wholesale and for Exportation. Farringdon Road, ncsr Clerkenwell Green, London. E C.

ADANK, J. JAQUES & Co., Manufacturers of Musical Boxes. Prize medal at Philadelphia. St. Croix, Switzerlsnd.

OPTICIANS.

COHEN (JACOB) & CO., 36 and 37, Ely Place, E.C.; and Charterhouse Street, E.C., London; and 10, Rue Biranger, Paris.

SILVER CHAIN MANUFACTURER.

PHILLIPS HENRY, Manufacturer of Silver Guard and Albert Chains, Seal Keys, Bracelets, Necklets, &c., 24, Great Hampton Street, Birmingham.

SPECTACLE AND EYEGLASS MANUFACTURERS.

AWRENCE, N., 17, Holborn Hill, London, E.C.: Manufactory, Havelock Works, Walker Street. Shffield.

LAZARUS (S. J.) & CO., Mannfacturers of Spectacles and Eye Glasses, and every description of Optical Goods 129, London Wall, E.C.

TURRET AND RAILWAY CLOCK MAKERS.

MILLAR, H. & R., Castle Bank Works, Edinbnrgh. Turret, Quarter, Chime, and Railway Clocks, 20 per cent cheaper than other makers. The only steam power factory in Scotland. Photograghs. Established 1840.

WATCH DIAL PLATE MAKER.

WILLIS, THOMAS J., 10, Rydon Crescent, St. John Street Road, London, E.C.

WATCH BALANCE MAKER

COLLIS S. HASTINGS, 37, Whiskin Street, London, E.C

WATCH CAP MAKER.

BAKER, WILLIAM, 10, Meredith Street, Clerkenwell London, E.C.

WATCH CASE MAKERS.

DUNN. HENRY, 48, Rahere Street, Goswell Road, London. E.C.

NEWMAN, JAMES THOMAS, 42, Spencer Street, Goswell Road, London, E.C.

STRAM, ALFRED, 12, Ashby Street, London, E.C.

WATCH MANUFACTURERS.

HARGREAVES (L) & CO., Wholesale Watch Manufacturers. 11, Slater Street, Liverpool.

HILL (THOMAS) & CO., 1, Hearsall Terrace, Coventry Watches for Home and Export Trade.

MICHAEL, MAURICE. Full Plate, Three-quarter Plates Centre Seconds, and Keyless Watches. For Home and Export. Norfolk Street, Coventry.

NEWSOME & YEOMANS, Wholesale Wstch Manufacturers, Spon Street, Coventry. The performance of all our watches guarsnteed for a number of years.

PENLINGTON & HUTTON, Chronometer and Watch Manufacturers, 2 and 3, St. George's Crescent, Liverpool.

SWINDEN & SONS, 27, 28 & 29, Temple Street, Birminghsm.

WATCH AND CLOCK MATERIAL DEALERS.

BEDFORD, H. E., 12, Crown Street, Halifax.

COWEN, DAVID, 28, Withy Grove, Manchester.

MEREDITH (WILLIAM) & SON, 260, Goswell Road, London, E.C.

SAGGERSON, ROBERT, Wheel Cutter and Dealer in Watch Materials, Files, Tools, &c., Prescot, Lancashire.

SWINDEN & SONS, 27, 28 & 29, Temple Street, Birmingham.

THOMAS, WILLIAM, 7, Great Sutton Street, Clsrkenwell, London, E.C.

THOMPSON (EDWARD JOHN) & VINE, 146, Goswell Road, London, E.C.

WEDDING RING MAKER.

ASTON, HENRY M, the original Wedding and Keeper Ring Manufacturer. An Extensive and varied stock always on hand. 12 Regent Place, Birmingham.

WORKING JEWELLERS.

CLEMENTS, HANDLEY & Co., 19, St. John's Square, Clerkenwell, E.C., all kinds of jewellery repaired on the shortest notice. Gilding, Plating, and Mounting for the Trade. (*See* advertisement).

JOHN ROBERT WILLIAMS & SON,

MANUFACTURING JEWELLERS AND GOLDSMITHS,

DEALERS IN DIAMONDS AND COLOURED STONES.

Warehouse: 108, Hatton Garden, E.C.

CHOICE BRILLIANT AND GEM RINGS. FINE SILVER-SET DIAMOND WORK. DIAMOND SUITES IN GOLD AND ENAMEL, ETC., ETC.

A Large and Choice Stock always on hand for selection.

THE
WATCHMAKER
JEWELLER.
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W H TILBY

A MONTHLY TRADE JOURNAL,

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

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HOROLOGY.

(*Continued from page* 51.)

XXVIII.—Its Relations to Astronomy.

By G. B. Miller.

THE results of all these forces must affect the position of the stars and planets as seen from our earth. Their longitudes being reckoned from the equinoxes, the precession of these points would increase the longitude; but as it affects all the stars and planets alike, it would make no real or apparent change in their relative positions. Nutation, however, affects the celestial latitudes and longitudes, as the real motion of the earth's polar axis changes the relative positions. So great is the variation that our present pole star has changed from 12° to 1°24′; in regard to the celestial pole, the gradual approximation will continue until it is within 0° 30′, after which it will leave the pole indefinitely until in 12,934 years a Syrae will be the pole star.

So far we have given only the causes which affect the meridian and consequently our standard for time; but that point being established for the yearly and diurnal revolutions, it becomes necessary to find some means to divide the day into minute fractional parts, such as seconds and parts of seconds. This, it has been stated, is effected by means of an isochronous pendulum. On this instrument no comment is required; but of the causes that disturb its accuracy much is needed. In 1672, at Cayenne, the astronomer Richter, while taking transits of fixed stars, found his clock lost 2′ 28″ per day. This was an error that arrested his attention, and he immediately attributed it to some variation in the length of the pendulum due to other causes than atmospheric changes and expansion. He determined the length of a pendulum beating seconds in that latitude, which was 5°N. in South America. He found that that pendulum was shorter than one beating seconds in Paris, by 0833 + of an inch. Now, if the earth was a sphere, the attraction of gravition at all places on its surface would be equal, and the oscillations of a pendulum would also be equal, + or —the disturbing effect of centrifugal force—an amount that can be easily determined. The real reason of the variation is found in the configuration of the earth.

The amount of the attraction of gravitation at any point of the earth's surface is found by the distance traversed by any body during the first second of its fall. The pendulum is a falling body, and is therefore subject to the laws of gravitation; the centrifugal force is measured by any deflection from a tangent to the earth's surface in a second. It follows that the centrifugal force at the poles, where there is the least motion, would not be equal to the force of gravitation, and at the equator must be exactly equal; but the deflection of a circle from a tangent measures the intensity of the earth's attraction, and is equal to the versed sine of the arc described during that time; the velocity of the earth's rotation being known, the value of the arc is deducible. The centrifugal force at the equator is equal to $\frac{1}{289}$th part of the attraction of gravitation. Again, the uniformity of the earth's mass becomes an object of consideration. Assuming that the figure of the earth is an ellipsoid of rotation, we will show the relation that form bears to the equal oscillation of a pendulum.

Taking the earth as a homogenous mass, analysis gives us the certainty that if the intensity of gravitation at the equator be taken as unity, the increase of gravity to the poles eliminating the differences of the centrifugal force must be equal to 2·5, the ratio of the centrifugal force to that of gravitation at the equator. Now, taking the 2·5 of ·346 = $\frac{1}{115}\,\frac{0}{2}$, this then must be the total increase of gravitation. If we knew the exact amount of increase at every point, from the equator to the poles, a perfect map of the form of the earth could be produced from calculation; experiment being from physical causes totally impracticable. The following analysis, quoted from an eminent physicist, gives a very lucid idea of the reasonings.

"If the earth were a homogenous sphere without rotation, its attraction on bodies on its surface would be everywhere equal. If it be elliptical and of variable density, the force of gravity ought to increase in intensity from the equator to the pole as *unity plus*, a constant quantity multiplied into the square of the sine of the latitude. But for a spheroid in rotation the centrifugal varies, by the law of mechanics, as the square of the sine of the latitude from the equator, where it is greatest, to the poles, where it is least. And as it tends to make bodies fly off the surface, it diminishes the force of gravity by a small quantity. Hence, by gravitation, which is the difference of these two forces, the fall of bodies ought to be accelerated from the equator to the poles proportionably to the square of the sine of the latitude, and the weight of the body ought to increase in that ratio."

Assuming the above reasoning to be correct, it follows that the rate of descent of falling bodies will be accelerated in the transition from the equator to the poles. Now, it has been before stated that the pendulum is a falling body, therefore, with the same length of pendulum, the oscillation at the pole should be faster than at the equator. Theory, in this case, is verified, for it has been proved by experiments, repeated again and again, that a pendulum oscillating 86,400 times in a mean day at the equator, will give the same number of oscillations at any other point, provided its length is made longer in the exact ratio as the square of the sine of the latitude. The sequence to be derived from all the fore-going considerations is, that the whole decrease of gravitation from the equator to the poles is 0,005·1449, which substracted from the $\frac{1}{115}\,\frac{0}{2}$ gives the amount of compression of the earth to be nearly $\frac{1}{285}\,\frac{0}{26}$. But this form of the earth would give the excess of the equatorial axis over the polar about 26½ miles. The measurement is confirmed by Mr. Ivory in his investigations on the five principal measurements of arcs of the meridian in Peru, India, France, England, and Lapland. He found that the law required an ellipsoid of revolution, the equatorial radius of which should be 3,962,824 miles, and the polar 3,949,585 miles; the difference is 13,239 miles. This quantity multiplied by two gives 26·478 as the excess of one diameter over the other. Thus, by two different processes the figure of the earth has been determined; but another remains, that is the result of pure analysis, derived from the nutation and precession of the equinoxes; for, as explained before, these effects are caused by the excess of matter at the earth's equator. The calculation does not lead us to certainty, but it does show the compression to be comprised between the two fractions $\frac{1}{270}$ and $\frac{1}{573}$. There is this advantage in the lunar theory, that it takes the earth as a whole, disregarding any irregularities of surface, or the local attractions that influence the pendulum—the difficulties of measuring an arc of the meridian being an obstacle to perfect accuracy.

The form of the earth has, however, a value confined not alone to those interested in horology, it furnishes us with a standard of weights and measures. In England and the United States, the pendulum is the unit of mensuration, or at least the common standard from which measurement is derived. It has been shown that deducting the effects of nutation, the axis of the earth's rotation is always in the same plane. Now, the mass being the same constant quantity, a pendulum oscillating seconds at Greenwich Observatory has been adopted by the English Government as its standard of length. Oscillating in vacuo at the level of the sea, at 62° Fahr., Captain Kater found its approximate length to be 39·1393 inches; as this must be invariable under the same circumstances, it becomes a standard for all time. The French deduced their standard from the measurement of the ten-millionth part of a quadrant of the meridian passing through Formentera and Greenwich. They have also adopted the decimal system; yet it seems to prove that nothing under the sun is new, for over forty centuries ago the Chinese used the decimal system in the division of degrees, weights, and measures. The antiquity of the pendulum is also shown by the fact that the Arabs were in the habit of dividing the time in observations, by its oscillations, when Ibn Iunis, in the year one thousand, was making his astronomical researches. Before we lose sight of the influence of the form of the earth on the pendulum, it may be well to state another source of disturbance, arising from the combined influence of the earth's rotation, and the facts that a body moving in its own plane seeks to maintain that plane. It will be seen from the very beautiful experiment showing the rotation of the earth, that if a body like a pendulum be suspended so as to be free in every direction, and not be influenced by the motion of the earth when set in oscillation in any plane, that such plane will preserve its line of motion, while the earth in its motion beneath the body can be seen to slowly move, as though the minute hand of a watch were made stationary while the dial revolved. The same principle is the one that maintains the spinning-top in a parallel position to the horizon, or the gyrascope in its apparently anomalous defiance of all the laws of gravitation. In the pendulum this tendency to preserve the same plane of motion becomes a cause of error, slight, it is true, but one which can be very easily remedied by so placing it that the plane of oscillation shall be parallel to the equator. It will be readily seen that this precaution will become more important as we recede from the equator; for if we were to suspend a pendulum at the pole in a true line with the axis of rotation, and if the plane of vibration remained constant, the earth would turn once around that plane in the diurnal period. During this time there would be a continuous torsion on the point of suspension, that would in time materially effect the accuracy of the instrument. The reasoning holds good for every latitude, degree of influence being the only difference. Having given the action of the earth's form, mass, and rotation on the pendulum, there remain the disturbances due to expansion and contraction, owing to changes of temperature, and thoes of atmospheric causes; the astonomical points to be observed are somewhat too fully laid down, but it must be remembered that an exact science requires the premises to be fully established before a sequence can be drawn.

As the standard of time depends on the passage of a star or the sun, or any known celestial object, at a certain time across the meridian of the place where the observation is taken, it was absolutely necessary to give the modes of calculation, together with the disturbing causes. Moreover, a full appreciation of the indebtedness of horology to astronomy could not be obtained without a general knowledge of the change of the position of the major axis of the orbit described by the earth around the sun. Also the difference between mean and apparent solar time was required to illustrate the use of the tables of equated time, the necessity of which will become patent when the use of the transit instrument, for the establishment of time, on a fixed standard, is introduced. Also, the disturbing effects of the sun and moon collectively and relatively as to position, could not be passed, as they produce the precession of the equinoxes and the nutation of the pole—essential elements in the computation of time.

There is, however, another consideration in estimating the accuracy of the pendulum, depending not on the *form* of the earth, but its want of uniform density; thus, if we suspend a plumb bob near a mountain, we find a certain amount of deflection from the true straight line to the centre of the earth, in other words, the plumb line does not coincide with the true line of attraction of gravitation. Thus, in northern Italy the deflection of the plumb bob was found to be five or six times as much as the deflection caused by the immense mass of Chimborazo, in Mexico. We can attribute this variation to only one cause, a preponderating attraction of gravitation by some hidden mass in the earth. Bouguer, while measuring an arc of the meridian in Mexico, found that in the vicinity of the Chimborago peak, his plumb line was out of the true vertical; and, as in the case of Mahomet, the mountain would not come, so the bob was deflected to the mountain. It must be understood that the attraction of gravitation is not to be considered simply in the fact of a body falling to the earth, but the mutual attraction existing, or rather caused, between two bodies in position, modified by the superior force exerted by the earth; for the attraction of gravitation is in proportion to the mass of each body acted on, and it has been demonstrated by Newton, that a particle of matter placed without the surface of a hollow sphere, is attracted by it in the same degree as though the whole amount of matter composing the sphere were concentrated in a compact mass in the centre. We would therefore expect that a small body in proximity to a larger, should be attracted in just the proportion of the two masses. Except in the case of the pendulum, no direct horological interest pertains to a further consideration of the laws of gravitation. Yet in observations for the passage of astral bodies over the meridian, all the calculations are modified, more or less, by the influence of mutual attraction; it will not, then, be amiss to spend a few minutes in its further consideration, as the great law laid down by the immortal Newton was the true father of subsequent astronomical science, and consequently Horology should acknowledge its value and admit its claims.

It has been stated that the attraction of a mass of matter, external to a hollow sphere, is the same as though the sphere was concentrated in a mass at its centre; but it has also been shown by the action of the earth on the pendulum, that in a spheroid the same law does not hold good, for the pendulum is found to fall; in other words, vibrate faster at the poles than at the equator. The slight differences in the polar and equatorial axis of the sun, planets, and fixed stars, compared with their immense distances, may be disregarded, and the various bodies considered as true spheres, obeying the law propounded by Newton. He also proved that the moon is held to her orbit of revolution around the earth by the same force that causes a body to fall to the earth. But the moon is the nearest body to the earth, and it is a law of gravitation that its force is exerted in the inverse proportion of the squares of the distances; therefore we find that in obedience to this law, the moon is really more of a disturbing cause than the sun in proportion to the mass. The figure of the earth, however, is not a perfect sphere; therefore the moon, in portions of her orbit, being out of the line of the centres of gravity that join the two bodies, causes a disturbance of the protuberance of matter at the earth's equator, and consequently of the polar axis, as we have shown when treating of nutation, the attraction of the two bodies being in proportion to their masses. The pendulum vibrates more rapidly at the poles, and, therefore, we infer that at that point the attraction of gravitation is greater than at the equator; the law of the increase being as the squares of sines of the latitude, we can find between the equator and the pole some circle of latitude, where all falling bodies would be equally affected by the attraction of the earth, and on that parallel it has been demonstrated by the Atwood machine that a body falling in vacuo traverses the space of 16·0697 feet in the first second of its fall. Taking this as the mean constant quantity, we can easily weigh the mass of the earth or moon, by ascertaining, by the analysis of the law, through how great a space the earth would fall toward the sun, and the same as regards the moon in her relation to the earth. In this calculation we would leave out altogether the centrifugal force of both bodies' motion in their respective orbits around their centres of gravitation.

(*To be continued.*)

QUERIES AND REPLIES.

O. M. M. asks through a contemporary: "How to make gold lacquer?"
A.—To 1 gallon of methylated spirits of wine, add 10 ozs. seed lac, and 4½ ozs. of red sanders, dissolve and strain.

J. W. D. McC. asks: "Can copper be galvanized with gold? If so, what is the most simple but effectual method?"
A.—A hot aqueous solution of the double cyanide of gold and potassium is used for the bath, with a battery of over two Smee cells for small work. Or the gold solution may be poured into a porous cup immersed in a quantity of salt water contained in a small copper cup. The whole is set on a fire until the gold solution has attained a temperature of about 110° Fah. A rod or plate of zinc is then placed in the salt bath, and the article to be plated, previously thoroughly cleaned, is immersed in the gold solution, and connected by means of a copper wire with the zinc. Under these conditions a deposit is soon obtained.

J. S. B. asks: 1. "How can I electro-plate with gold and the deposit have the appearance of 16 and 18 carat gold?"
A.—The following is said to give fine results when properly worked. Make the anode of an alloy composed of 1 part silver, 9 parts copper, and 30 parts gold. Immerse this, connected with the positive pole of strong battery, in a hot aqueous solution of potassium cyanide contained in a small porous cup, and place the cup in a large vessel of copper. Fill up around the cup with water to which has been added a little ammonium nitrate, connect the copper with the zinc of the battery, and heat the whole to about 110° Fah. in a stove, while the current is passing. When the solution has taken up enough of the alloy, (which may be determined by means of an hydrometer, or by weighing the dry plate before and after), remove the solution and plate from it in the usual manner, using the alloyed anode.

2. "By what means can I best solder small pieces of steel together?"
A.—Heat the joint sufficiently, flux with acid zinc chloride solution, and use a plumber's solder.

3. "How can I best nickel plate on zinc?"
A.—Give the zinc a good coating of copper, using a strong battery, and then plate on the nickel from an ammonia-nickel chloride bath.

W. F. R. & Co. ask how to re-colour green bronze French statuary that has become broken?
A.—Dissolve 1 oz. sal ammoniac, 3 oz. cream of tartar, 6 oz. common salt in 1 pint of hot water; add 2 ozs. copper nitrate in a pint of hot water. Mix well together, and apply with a brush to the parts repeatedly.

R. M. says: "Would be obliged if any of your correspondents would inform me if in a scientific point, an India-rubber cloth, or macintosh bag for a fine watch would in any way injure or alter its time-keeping."

SOUTH AFRICAN DIAMONDS.

MAJOR LANYON'S report on Griqualand West for the year 1875 has just been issued, the delay having been caused by the absence of any colonial secretary to prepare the report, which the administrator has had consequently to supervise himself, being able to do it at irregular times. Writing at the end of last year, he says:—At the present time the chief product of the province is diamonds. In certain parts, where farmers have settled and established themselves before this became a British possession, a certain amount of wool is produced, but the exports under this head cannot be fairly estimated. As regards diamonds, however, a fair estimate can be given. During the year there was forwarded through the Post office alone over 700 pounds weight, (avoirdupois.) As only the better sort of diamonds are forwarded in this way, it is not estimating the value of this too highly when I put it down at £1,400,000. Of course this does not by any means represent the total amount of exports under this head. Large amounts are sent home by shippers through private sources, and there is no doubt that very large quantities are clandestinely sent home by the illicit diamond buyers, whose name is "legion." The temptations and facilities to the workers in the mines to steal are very great, and although the penalties are very severe, both to the thief and the receiver, the large gains to be made are too tempting for any penalties to stop this demoralizing trade. I do not think I am overstating the total value of the diamonds found in the province during the year 1876 when I put it down at £2,500,000. The following short report will be interesting as showing the prices obtained during the year for diamonds. It is compiled by a gentleman here who is a large digger and exporter. 1875 has been the most prosperous year our digging community has ever experienced. Although prices were not, perhaps, quite as high as at the opening of these fields, good quality diamonds of ordinary size fetched nearly as much as ever they did, and very choice stones realized fancy prices. I have known a 2 carat stone fetch £20, and other small stones in proportion, but these were of course exceptions. The market gradually rose from the beginning of the year to the end of May, when it receded slightly, keeping, however, very firm to the end. On reference to my register, I find that in the month before the excessive rise I purchased 75 stones weighing 244 carats. (nearly 3¼ carats, average,) at 205s. per carat, while in December I paid as much as 160s. for 16 diamonds weighing 51½ carats, a similar average, and as far as my memory serves me of equal quality. Ordinary diggers parcels as found in washing and exclusive of pickings, which are generally of a more valuable description, may be estimated at 30s. per carat during the year, a load of good ground yielding equal to 1¼ carats washed. The average prices of white and Cape white diamonds, perfect in shape and free from flaws, varied during the year from 50s. to 80s. for stones of ½ to 1½ carats to £8 10s. to £10 10s. for stones of 4 to 5 carats. Larger sizes varied considerably, and 9 to 10 carat stones sold for about £15 per carat. First bye-water or slightly off-coloured would be one-half of the above quotations. Light yellow stones, but otherwise perfect, varied from 25s. to £4 per stone of 1 to 5 carats, to £8 10s. to £10 for stones of 40 to 80 carats. Dark yellow stones were about 25 per cent. cheaper. The high price paid for superior goods is to some extent traceable to the competition caused by American orders to be executed in time for the Philadelphia Exhibition. I may mention, as useful for reference, that a carat equals 3 1-5th grains troy. The most common shape of the diamond when found is octahedron, but it assumes all shapes.—*Globe.*

A MAGNIFICENT service of plate, costing 6000 guineas, and paid for by private subscription, was presented on the 5th ult. to the Manchester Corporation by Mr. Alderman Curtis, the ex-Mayor, during whose mayoralty the subscription was promoted. It will be used at the banquet in celebration of the opening of the new Town Hall. The plate has been manufactured by Messrs. Elkington & Co., and consists of a silver gilt and oxide dessert service, early English in design. It comprises a plateau 14 feet long, and bearing the enamelled arms of Lancaster, the Bishop of Manchester, Mr. Alderman Curtis, the Royal arms, and 20 shields containing the names of the principal incorporated towns of the county. Between the shields are engraved the names of the past mayors of the city, and in two large shields are the names of the subscribers. There are also three large oval centre pieces, ten tall fruit stands, twenty-four compotiers, two thirteen-light candelabra, ten nine-light candelabra, and twenty-four ice dishes, all *en suite*.

THE TAXATION OF SILVER PLATE.

The following paper on the Taxation of Silver Plate was read by Mr. E. J. Watherston of Pall Mall, at the Social Science Congress recently held at Aberdeen:—

Were it not for its direct influence upon the causes of art progress and of technical education, I should hesitate before bringing the subject of the Taxation of Silver Plate before the members of this section.

However, these interests are seemingly such as deserve attention on the part of those who have at heart the development of the trade of the country, and I have the satisfaction of knowing that proposals emanating from a really practical member of any craft will find attentive consideration from the members of an association, formed especially with the view to the discussion of social questions affecting the interests of the community.

Before proceeding to indicate the degree in which the taxation of silver plate is obstructive to art-progress, and an insurmountable obstacle to technical education in its application to silversmiths' work, it will be necessary for me to trace the origin of the tax, and to describe its direct bearing upon the trade of the silversmith.

A tax of sixpence per ounce was first levied upon silver plate in the year 1719.* In 1758 it was repealed, as was then said "for the encouragement of the trade." It may therefore be presumed that the tax had, even in those days, been found to be depressing in its effect upon the trade. In 1784,† however, the tax was again imposed. In 1797 it was raised to one shilling; in 1804 to fifteen-pence, and in 1815‡ it was again raised to eighteen-pence an ounce, at which it still remains.

The dates are significant. It is a war tax! This is proved by the history of the National Debt. At the accession of William III. the National Debt amounted to £664,263 sterling, the result of the Revolution of 1689. The debt at the accession of Queen Anne amounted to £16,394,702; at her death in 1714 it had increased to £54,145,363.

The advisers of George I. recommended the attempt to pay off the National Debt, and between his accession in 1714 and 1727, the date of his death, a sum of £2,053,125 was paid off. Hence the tax upon Silver plate, from which, in common with many other articles, it was sought to provide the means of repayment. From A.D. 1727, the date of the accession of George II., until the Peace of Paris in 1763, three years after the date of the accession of George III., a sum of £86,773,192 was added to the National Debt, making the total indebtedness £138,865,430. Between 1763 and 1775, the date of the commencement of the American War, a sum of £10,281,795 was paid off. The American war cost £121,267,993. At its conclusion, in 1784, the debt stood at £249,851,628, and in the peace which followed, until 1793, a sum of £10,501,380 was paid off. The French war cost £601,500,343, so that in 1817 the National Debt amounted to £840,850,491 sterling.

At this time, as we all know, protection reigned profound. The country, alarmed at the consequences of war, and overwhelmed with a sense of the responsibility of debt, sought by taxing every article of commerce to provide the means of payment for interest, which at that time amounted to no less a sum than £32,038,191 per annum. This state of things continued, without alteration, until the commencement of the free trade agitation, since when taxes have been abolished in the case of not less than twelve hundred different articles, the tendency of modern legislation being to concentration of duties upon the great articles of every day consumption, viz., tobacco, spirits, wine, beer, and tea; the principle being that as traders are relieved from taxation, so in like degree they contribute more and more to the revenue derived from those articles, and to the income tax, which now produces £1,700,000 to the penny, in the place of £800,000 in the year 1843! That this is a successful policy, and no longer a matter of theory, the following figures will show:—During the last fifteen years, the actual diminution of taxation amounts to £30,837,689. In the same period the revenue increased from £70,283,674 in 1861 to £77,131,693 in 1876, and the National Debt decreased by nearly £26,000,000. I should be taking up the time of the section unnecessarily were I to do more than mention the fact, that all this has been accomplished in the face of enormous sums spent in many directions, among which "Army Compensation," "The Alabama Claims,"§ and the "Suez Canal Shares,"‖ are notorious examples!

Doubtless all this increased prosperity is to be traced to the enormous findings of gold; but I apprehend that the fact of the world's treasures having been scattered broadcast over the surface of society in Great Britain, is to be attributed to the free-trade principles which have prevailed during the last quarter of a century.

Probably the Post Office returns are among the best proofs of the advantages of untaxed commerce. During the year 1875, 1009 million letters and 79 million post-cards were delivered in the United Kingdom. In addition to these, 280 millions of newspapers and book parcels passed through the Post Office. Comparing these figures with those of 1866, when there were no post cards, we find an increase of 259 million letters, and 183 million newspapers and book packets. Who will say that these results have not been mainly caused by the abolition of taxes?

I will now ask the attention of the section to the present condition of the silver trade. It must be remembered that, whereas taxation has been abolished in the case of all similar trades (of course including numerous trades in articles of luxury), the silver trade is still fettered by a tax of eighteen-pence an ounce, which amounts, upon the wholesale price of spoons and forks, to 20 per cent., and upon articles of every-day use, such as tea and coffee services, waiters, cruet-stands, and candelabra, to 12½ per cent. The injustice of the duty is demonstrated by the facts that no other similar trade is taxed, and that silversmiths have to compete with electro-platers, whose goods, composed of a metal of only nominal value, are wholly untaxed, and, by a strange anomaly, are permitted to assume marks closely resembling the hall-mark upon the genuine article. Doubtless the introduction of electro-plate was a serious blow to the silver trade; but, for this very reason, the taxation of silver plate ought to have been abolished twenty-five years ago.

It is true that many people buy electro-plate rather than be worried by the responsibility of silver, but this is no argument why one trade should be absolutely free, and the other, by taxation, be confined within the narrowest possible limits.

The impolicy of the tax, unhappily, is but too perceptible.

In the year ended March 31st, 1855, the amount of silver plate upon which duty was paid, amounted to 994,360 ounces. In 1861 the amount had fallen to 893,493. In 1875 to 886,493. In 1876 to 870,507, and in 1877 it had again fallen to 798,206 ounces. In twenty-three years, therefore, in the face of enormously increased national wealth, almost incalculable, the trade of the silversmith has decreased by no less an amount than 196,154 ounces, equal to a wholesale trade of about £100,000 a year! The result of which, as might be supposed, is that there are fewer manufacturers, and less capital embarked in the wholesale trade now than twenty-five years ago.

It may be asked, "why, then, if this be so, has the tax not been long since abolished?" The answer is two-fold—firstly, because the tax costs a very small sum to collect; secondly, because manufacturers are personally interested in its continuance. The tax is collected principally by the Goldsmith's Company. There are also Halls at Birmingham, Sheffield, York, Exeter, Chester, Newcastle-on-Tyne, Edinburgh, Glasgow, and Dublin. Birmingham and Sheffield collect about £6,500 a year each. York has produced nothing for several years past: Chester next to nothing: Newcastle only £139: Exeter about £2000. Edinburgh and Glasgow about £850 each, and Dublin about £650. The average of the duty collected by the Goldsmiths' Company during the last fifteen years is £14,091 per annum. The allowance for collection is, in England 1 per cent.; in Scotland 2½ per cent.; in Ireland 5 per cent. The Goldsmiths' Company obtain the largest share of business, for the simple reason that "London made" plate sells better than "Country made;" therefore country manufacturers, as a rule, send their goods up to London to be marked. But manufacturers hug the tax for a reason which is one of the very best arguments for its abolition. It produces to them a profit of itself. A rebate of duty of three-pence an ounce is allowed upon unfinished plate. By sending goods to the Halls as nearly finished as possible, a profit is thus secured of about two-pence an ounce. The manufacturer, in point of fact, only pays fifteen-pence an ounce upon unfinished plate, consequently, the more nearly the goods are finished the less the loss after marking. Upon an annual trade of 120,000 ounces, there is thus secured a profit to the manufacturer, upon duty alone, of £1000 a year.

Manufacturers and dealers naturally cling to the duty out of consideration for their existing stocks of duty-paid plate, but whatever present loss its abolition might entail, would soon be recouped by enormously increased trade. There is, however, no reason to apprehend that the loss would be very great, inasmuch as, it may be safely assumed, that the Chancellor of the Exchequer, recognizing their just claims for compensation, and finding that no more than £100,000, would be required for the purpose, would be willing to grant it.

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* To pay for the Spanish war. † To pay for the American war.
‡ To pay for the French War.
§ £3,196,875. ‖ £4,076,565.

The impolicy of the tax may also be shown by its operation upon exported plate. It is true that a drawback is allowed, but the expenses of obtaining it amount to a tax. In the first place, an agent is required to convey the goods to the port of exportation. The articles, whatever they may be, must be packed in an open case. Upon arrival at the port, the plate has to be taken out and weighed; ivory handles must be detached; knife handles must be drawn; every conceivable hindrance is offered to the trader. Lastly, goods are left to the tender mercies of irresponsible packers, and arrive at their destination in anything but a satisfactory condition. In many instances drawback is not obtainable at all without a certificate from the manufacturer, as in the case of spoons and forks with *loaded handles;* and, in the case of small parcels, the expenses of collecting drawback often exceed the amount of the duty itself. It was lately found that the cost of collecting 19s. 7d. amounted to 23s.; and, with reference to the repacking of exported plate it may be remarked that, only lately, a pair of candelabra, forwarded to Sir Salar Jung, in India, arrived seriously broken, rendering a return trip to England necessary for the purposes of repair, when they will be met by the duty upon importation, and the same red tapism must be gone through again upon their re-exportation.

Under such a state of things, it is not surprising that these obstructions, arising from the tax, should have militated seriously against the export trade, and have diminished it, as they really have done, by 46,000 ounces a year, judging by the figures of the last few years, handing it over to America, Germany, Austria, Italy, and Denmark, where no such obstruction exists. In France the Droits de Controle are about sixpence an ounce. In no part of the world is there such a tax as that levied in Great Britain. The method of exporting plate from France, in the case of newly manufactured articles, is this; and it is the same with jewellery:—goods are taken to the Customs, in Paris, or elsewhere, packed, sealed, and registered through, with no trouble to the merchant or his customer.

Permit me now to call special attention to the effect of the duty upon the price of silver goods.

Taking a manufacturer's stock at say 50,000 ounces, it follows that he has a capital embarked, in duty alone, of £3,750; this capital must be taken into consideration upon making his profit. Therefore the public pay the tax, plus manufacturer's profit, plus retailer's profit upon the gross. It may thus be said that the public pay a tax upon silver plate of at least two shillings an ounce, or two-fifths of the value of the material itself.

I hope I have clearly proved that the taxation of silver plate is depressive to trade, and subversive of the principles of modern legislation. I will now very rapidly refer to the tax as obstructive to art-progress.

A visit to South Kensington would at once illustrate the truth of the proposition. Here we find scores of students whose object it is to work into the several branches of trade. Doubtless there are many in this room who are aware of the gigantic work of education now prevailing under the influence of the Science and Art Department.

A glance at the Schools will suffice to show the great preference given by the students to those trades which are hampered by no restrictions, such as carpets, furniture, decoration, curtains, paper-hangings, brasswork, fenders, mechanical engineering, anything, indeed, but to the silver trade! And why? Because the silver trade, being taxed, and consequently confined within the narrowest possible limits (the whole trade of the United Kingdom not amounting to more than £400,000 a year), offers no temptation to artists to adopt it as a profession. It is not the nature of a declining trade to attract labour or capital to it; whereas, the trades above named not only attract labour and capital to themselves, but offer the very highest rewards to artists of eminence for their successful development.

Sixty thousand pounds a year is an excessive estimate of the aggregate nett profits of all the manufacturers of silver plate in the United Kingdom, obviously proving the impossibility of high salaries being given to artists. How different is the state of things in America, where one manufacturer, giving employment to 800 hands, works up, annually, more silver than all the British silversmiths put together! It may be added that his goods are of highly artistic excellence, finding a ready sale in all parts of the continent.

With reference to technical education, it is manifest that no scheme, however wisely devised, can benefit the silver trade until the tax is abolished.

In the first place, for so unremunerative a trade, no one will care to be technically educated.

Secondly, inasmuch as every scheme must include theory and practice, it is plain that so long as the tax exists, there must be a serious hindrance to the work of education. So long as a law remains in force that, before an article is put together, almost in its rough state, it must be sent to Hall and a duty of from 12½ to 20 per cent. be paid upon it, it is useless to talk about technical education for the silversmith. The difficulties are, in point of fact, insurmountable. I apprehend that the first part of any scheme of education for the silversmith would be "Research." First, find out what good work has been done in times past by reference to the museums of Italy, Vienna, Berlin, Dresden, Munich, the Louvre, and the Hotel Cluny, where masterpieces of art are to be found, reproductions of many of which may be seen at the South Kensington Museum. It is lamentable to consider the extent to which the art of the silversmith has degenerated in this country since the 14th century, at which period England was pre-eminent in the production of silver plate.

I find the following statement in De Lasteyries' "Bibliothèque des Merveilles":—"Nulle doute que l'orfevrerie Anglaise du quatorzième siècle n'eût une réelle valeur d'art; car nous la voyons recherchée même en France, où plusieurs pièces de cette provenance figurent parmi les innombrables richesses que renfermait le trésor de nos rois. Dans l'inventaire de Charles V. se trouve un fermail émaillé qu'il avait lui-même rapporté d'Angleterre, et dans celui de Charles VI. une aiguère, ainsi qu'un grand gobelet à pied et couvert tous deux en or emaillé que Henry IV. (de Lancastre) lui avait donnés."

To emulate these works should be the aim of the artistic silversmith. A knowledge of drawing, geometry, and chemistry we must assume to have been acquired by the student. It is satisfactory to note that as recently as June, 1876, there were upwards of 75,000 children being taught drawing in the London Board Schools. Lectures must be delivered upon such subjects as Mythology, Archæology, Botany, and Chemistry with a view to enamelling and combination of colours. Modelling must be taught by an experienced professor. Then follow alloying, melting, flatting, hammering, casting, chasing, engraving, polishing, burnishing, coloring, and finishing. Nothing in the shape of taxation should be allowed to interfere with the freedom of the school.

Upon these grounds I earnestly hope that in the interests of commerce and of art this unjust and impolitic tax may shortly be abolished.

PRODUCTION OF GOLD AND SILVER.

FROM the French *Journal Officiel* we extract the following figures, representing the total production of gold and silver from 1852 to 1875 throughout the civilized portions of the earth.

YEARS.	GOLD. Million Marks.	SILVER. Million Marks.	YEARS.	GOLD. Million Marks.	SILVER Million Marks.
1852.	766.	170.	1864.	470.	216.
1853.	552.	170.	1865.	504.	218.
1854.	534.	170.	1866.	508.	212.
1855.	568.	170.	1867.	488.	226.
1856.	620.	170.	1868.	504.	210.
1857.	560.	170.	1869.	508.	200.
1858.	522.	170.	1870.	488.	214.
1859.	522.	170.	1871.	488.	256.
1860.	500.	170.	1872.	484.	274.
1861.	468.	178.	1873.	434.	294.
1862.	452.	190.	1874.	378.	300.
1863.	450.	206.	1875.	410.	340.

Total—Gold, 12,278; Silver 5,064 (*a mark=one shilling*).

CHINESE WATCHMAKERS IN CALIFORNIA.

THE *Révue Chronométrique* says that a Swiss watchmaker established a watch factory in California. Having ample capital at his disposal, he sent to his native country for machines and a few skilled workmen. Thanks to the protective system his speculation prospered, and he gradually closed the market to foreign importation. He had, however, reckoned without American hand-labour, which became so exacting as to render competition impossible. He then first entertained the idea of instructing Chinese, who took to the trade with remarkable facility; so that the undertaking is now well established, and in a flourishing condition.

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from* p. 29.)

In the hall of the Prince's College at Ratisbon, in 1731, stood a clock, made after the model of the one in Strasburg Cathedral (a description of which we gave in the August number of last year.) The quarters were struck by several figures; and every hour the three kings made their appearance and paid their adoration to the Virgin Mary and her Son, while the cock that was placed over them crowed. Upon one of the four sides of an old, short, square Gothic tower in Ratisbon, is a curious ancient clock, supported by human figures.

John Visconti, Archbishop of Milan, set up a clock at Genoa in 1353. It is supposed to have been a spring or wheel clock. The first clock at Bologna was fixed up in 1356. About the year 1364 or 1370 (probably the latter), Charles V., King of France, caused a great striking clock to be placed in the tower of his palace by Henry de Vick (some say Charles de Vick). He invited a clockmaker from Germany, because there was no artist of the kind in Paris. The principles upon which this clock was constructed were mainly the same as those of the clocks of the present day with a moving and also a regulating power. The former was a weight hung to a cord, wound round a barrel, the unwinding of which, by the fall of the weight, gave motion to a train of wheels that moved the hands round the dial. The regulating power was a balance wheel, swinging backwards and forwards after the manner of the watch balance. The maker appears to have been an ingenious man, who combined into one machine the inventions of the past ages.

The Tour de l'Horloge of the Palais de Justice, Paris, contains this famous clock, which was the first of the kind that the Parisians had seen. Charles V. appointed an officer, with a salary, to keep it in order. A little while after this clock was constructed another was made by a Frenchman, and put up at Montargis, with the following inscription:—"Charles le Quint me fit par Jean de Jouvence, (Charles the Fifth caused me to be made by Jean of Jouvence). Some years after another clock was put up at the cathedral of Sens, when the king paid one-half of the expense of a wooden case in which it was enclosed.

In 1368, Edward III., who, judging from his acts, had a liking for mechanical art, invited over from Delft to England three Dutch clockmakers, to whom he granted, by his letters patent, in the forty-second year of his reign, safe conduct and protection for one year to carry on, for their own profit, their lawful employment. No doubt the king found it necessary to invite skilled artificers from abroad, in consequence of clocks coming into general use, and of the paucity of good native workmen, and of there being many mere pretenders to the art of clockmaking.

Lehmann informs us that there was a clock at Spire in 1395.

In certain early documents preserved in the British Museum, clocks are mentioned as follows: Under date, May 13th, 1396, Jehan de Menelix, master of the works to the Duke of Orleans, certified that Thinoman Rogeret had made the Clock of Chateauneuf for the sum of thirty-six gold crowns. Under date, December, 1396, Pierre le Queux, "Orlaugeur," acknowledged the receipt of thirty gold crowns, at eighteen solz each, from Godeffroy le Fevre, valet of the chamber of the Duke of Orleans, "pour la vente de trois Auloiges." Under date October 7th, 1397, Robert Dorigny, "fevre," acknowledged the receipt of nine livres Fournois "pour avoir descendi et mis par membres le movement de l'orloge qui estoit en l'ostel de Mons. le Duc ā Asnièrè, et ycellui conduit et fait admener à ses fraiz ā Villers Costeret" by order of the Duchess. Under date, August 9th, 1401, Jehan Dalemaige, "serrurier," of Paris, acknowledged the receipt of sixty-six solz Paris, from the receiver of the finances of the Duchess of Orleans, "pour un mouvement ou petite Orloge acheté de lui pour mettre en la chambre de ma dite Dame." Under date, December 19th, 1407, Jehan Libourc "faiseur d'Orloges," at Paris, acknowledged the receipt of fifty-five solz tournois from the receiver general of the Conte d'Angoulesme, "pour deux roes et antres choses par lui mises pour l'Orloge de mon dit Seigneur."

The first clock seen in Spain was set up in the Cathedral of Seville in 1400. Carpentier, in his supplement to Du Cange, cites a decision of the Parliament of Paris in 1413, in which Henry Bye, one of the parties, is styled "Horologiatoris et custodis seu gubernatoris horologü palatü nostri Parisius."

By the churchwarden's accounts for Walberswick, Suffolk, we find that in 1451, the sum of eleven pence was "payd to the clockmaker;" and in the next following year the sum of 12s. 8d. was also paid to him. In 1495, the churchwardens "payd John Payn, of Southwold, the smyth, for a new cloke, 6s. 8d." This item interestingly illustrates the cost of early clocks, and shows that a smith was the seller of the one in question.

The works of early clocks were generally forged by smiths, who were in fact the clockmakers of that day. Probably the Walberswick clock, that cost only 6s. 8d., was an inferior one, and soon got out of order, for we find that the churchwardens in 1499 "Payd to Nicholas Schrebbys for the cloke" the several sums of £1 13s. 4d., 6s. 8d., £1 2s., and 13s. 4d.

Nürnberg or Nuremberg had a clock in 1462.

The will of John Baret, of Bury St. Edmunds, dated in 1463, contains the following bequest:—Itm "I wil yeve and be qwethe yeerly to the sexteyn of Seynt Marie chirche vüjs, to keep the clokke, take hede to the chymes, wynde vp the peys and the plummys as ofte as nede is." The "peys and the plummys" were the greater and lesser weights (the latter being probably formed of lead), from the French poids and plombs.

In the Procter's accounts for 1469, of St. Mary's at Oxford, is this item:—"Pro custodia horilogij, vjs vüjd." And in 1473, "Pro custodia horilogij, üijs." In 1523, St. Mary's was furnished with a clock, out of fines imposed on the negligent students of that university. In the Vice-Chancellor's accounts from 1550 to 1554 is an item of £1 14s. paid to Thomas Masey "for mendinge of St. Maryes clocke, 25 Junü, travellinge (working) by the space of two weekes thereon;" and 10d. were also paid for a lock to the same machine.

At the close of the fifteenth century, many of the principal cities of Europe were without public clocks, which could be procured only at great expense. Of this we have an instance in the city of Auxerre, the magistrates of which place, in the year 1483, ordered a clock to be made; but finding that it would cost a larger sum of money than that which they considered they had authority to dispose of, they applied to Charles VIII. to allow them to draw upon the public funds for the purpose.

In the annals of Dunstable Priory is this item:—"In 1483, made a clock over the pulpit." In early days an hour glass was used as a time measure in churches, and occasionally the priest had a watch found him by his parish.

As early as 1484, Walther, and after him the Landgrave of Hesse, made use of a balance clock for astronomical purposes. In the churchwardens' accounts for Wigtoft, near Boston, Lincolnshire, under date 1484, we find an item "paid to Ric Anngell for kepyng of (that is, looking after) the clok, 3s. 4d."; item, "paide for dressyng of the clok, 10d."; item, "paide to Robert Panlyn for di stone femble (femble or fimble, a kind of fine or female hemp) for lines to clock plumes (plumbs or lead weights), and for makyng of the same femble, 5d."; and item; "paide for nailes for the said clok, 1d." In the same accounts for 1511 is an item, "paid for i lyne for ye clocke, 3d.": and a similar item occurs in 1519. In 1523, item, "payd to the cloke-maker, 1s." In 1525, item, "payd to the cloke-maker, 5s."; item, "for clok meynddyng, 4s." And in 1531, item, "for makyn of yt and for clot lens (clock lines) makyn, 6d."

Venice had a clock in 1497. It appears from a letter written by Ambrosius Camaldulensis to Nicolaus of Florence, that clocks were not uncommon in private families on the continent at the end of the fifteenth century. About this time the town hall clock in the city of Prague was made by the celebrated astronomer, Hanusch, professor of mathematics in the university there. It exhibited the revolutions of the sun and moon, the day of the month, the length of the days and nights, and other things. A great portion of the movement was out of order about 1730. From the frequency with which the word clock occurs in the Earl of Northumberland's "Household Book," from 1512 to 1525, it is evident such mechanism was common in the period to which the volume refers.

In the Calendar of State Papers, temp. Henry VIII., we find a letter dated August 13th, 1516, from Tunstal to Cardinal Wolsey, in which the writer says that he had "prepared for the prelate a clock such as Richmond (described to) your Grace. It is all ready, save the case, and that it (may stay) a season by the maker to see as it goeth, that if any (lack) be it may be amended. As soon as it is trimmed I shall have it conveyed to your Grace." On September 1st following, Tunstal, dating from Brussels, again wrote to Wolsey, stating that he sent by Richmond a clock as a present, which Richmond would inform him how to set, and he enclosed "the key of the case and the vice," whatever that may have been. Wolsey died as a clock struck eight, on November 28th, 1530, he having during his preceding illness predicted that he should die at that hour.

In an account of the receipts and disbursements of the canons of the Priory of St. Mary, Huntingdon, for the years 1517 and 1518, is the following item: "Six bells of a tune, and a clock bell, whereof the deepness and bredth appeareth by the inventory."

Nuremberg has from the earliest times been famous for its manufacture of horological instruments. In the treasury at Vienna are many curious clocks and watches of early Nuremberg make. At a meeting of the Archæological Institute, held on December 3rd, 1852, Mr. Octavius Morgan, whose collection of time-keeping machines is very choice and extensive, exhibited a table-clock which was made at that city about 1525-50.

At a meeting of this Institute held in Gloucester in July, 1860, he displayed a clock or orrery constructed on the Ptolemaic system, the date of it being about 1540. At a meeting of the same Institute, held on December 7th, 1855, the same gentleman exhibited a clock in the form of an hexagonal temple, and bearing the date 1545. At a meeting of the Society of Antiquaries, held on March 1st, 1855, Mr. Morgan exhibited a cylindrical or drum-shaped table clock of silver-gilt, resembling the Bohemian clock in the Society's collection in form and construction, and is probably of the same date. The movement was entirely of steel, quite original, and in perfect condition. The hand revolved once in 24 hours, and the hours were numbered from 1 to 24. There were also on the face revolving discs and indices, showing the course of the sun and moon through the zodiac, and the age and phases of the moon. A mark at the bottom showed it to have been made at Nuremberg.

Numerous entries relating to clocks and watches, which latter are called clocks, occur in the accounts of the "Privy Purse Expenses of Henry VIII., from 1529 to 1532," edited by Sir Harris Nicolas. The king appears to have patronized foreign artizans only. We find cited payments to Nicholas, the astronomer, for mending a clock. This was doubtless Nicholas Cratzer, a Bavarian, "deviser of king's horologies," of whom notices will be seen in the third series of "Original Letters," edited by Sir H. Ellis, and a detailed account by Admiral Smyth in the "Archæologia," vol. 33, p. 14. Money was also paid to Anthony for a clock in a case of gold. In July, 1530, £15 were "paid to the Frenchman who sold the king ij clocks at Oking." In the following month was "paid to a Frenchman called Drulardy for iij dyalls and a clokk for the king's grace," another sum of £15.

In December of the same year more clocks were supplied to the king, £19 16s. 8d. being "paid to Vincent Keney, clok maker, for xj clokks and dialls." From the fact that the king ordered and paid for so many clocks and watches in the space of only a few months, we may assume that some of them were intended as presents to be given by him. About a year later, namely, in January, 1532, were paid out of the king's private purse "to the French clokmaker for ij clokks XXX corons (crowns), and a rewarde of XX corons, in all lv corons." On March 15th in the same year were "paid to one Lycile, a widowe, for vij cloke cases, XXV's., a pece." Another clock, "of iron with sundry dores of copper graven, showing howe the sec dothe ebbe and flowe," claims notice, as it may have been the astronomical clock constructed and presented to Henry by John Poynet, Bishop Winchester.

Among the many interesting articles which were collected by Horace Walpole, and lodged in his sham castle at Strawberry Hill, was a handsome little clock of brass (by mistake sometimes said to be silver-gilt), which had been presented by Henry VIII. to Anne Boleyn upon their marriage in 1532. It was given to Walpole by Lady Elizabeth Germaine. At the Strawberry Hill sale this famous clock was purchased by Queen Victoria for £110 5s., and it is now at Windsor Castle, in going order. "It is richly chased and engraved, and ornamented with fleur-de-lis and other things." On the top is placed a lion bearing the arms of England. The weights are chased with the initials of Henry and Anne within true lovers' knots. One bears the inscription, "The most happye," the other the royal motto. The clock has been repaired; the interior wheels are now all of brass, and the whole train is of comparatively recent date; while from the style of the mechanism and the adaptation for a pendulum an inference may be drawn that the repair took place about 1680. This clock will be found described in the "Archæologia" Vol. 34; in Shaw's "Dresses and Decorations"; and in "Knight's London," Vol 3, p. 160.

(*To be continued.*)

A SERIOUS robbery has lately been committed at the Museum of Leyden. During the visit of the Emperor of Brazil, a glass case was opened, to show the monarch some Egyptian jewels of great value. When the inspection was terminated the case was simply pushed to, and not fastened. After his Majesty's departure several very valuable stones were found to have been taken away.

TRANSPARENT GOLD.

IN the course of a lecture on gold, delivered before the Franklin Institute, on February 27th, Mr. A. E. Outerbridge, Jr. of the Assay Department of the mint in Philadelphia, gave an account of some experiments he had made, with the view of ascertaining how thin a film of gold was necessary to produce a fine gold colour. The plan adopted was as follows: From a sheet of copper rolled down to a thickness of $\frac{5}{1000}$ of an inch, he cut a strip 2½ by 4 inches. This strip, containing 20 square inches of surface, after being carefully cleaned and burnished, was weighed in a delicate assay balance. Sufficient gold to produce a fine gold colour, was then deposited on it by means of the battery, the strip was then dried without rubbing, and re-weighed, and found to have gained one tenth of a grain, thus showing that one grain of gold can, by this method, be made to cover 200 square inches, as compared to 75 square inches by beating. By calculation, based on the weight of a cubic inch of pure gold the thickness of the deposited film was ascertained to be $\frac{1}{980400}$ of an inch, as against $\frac{1}{367650}$ for the beaten film. An examination under the microscope showed the film to be continuous and not deposited in spots, the whole surface presenting the appearance of pure gold. Not being satisfied, however, with this proof, and desiring to examine the film by transmitted light, Mr. Outerbridge has since tried several methods for separating the film from the copper, and the following one has proved entirely successful:—

The gold-plating was removed from one side of the copper strip, and by immersing small pieces in weak nitric acid for several days, the copper was entirely dissolved, leaving the films of gold, intact, floating on the surface of the liquid. These were collected on strips of glass, to which they adhered on drying, and the image of one of them is here projected on the screen, by means of the gas microscope. You will observe that it is entirely continuous, of the characteristic bright green colour, and very transparent, as is shown by placing this slide of diatoms behind the film. By changing the position of the instrument, and throwing the image of the film on the screen by means of reflected light, as is here done, you will see its true colour. Mr. Outerbridge has continued his experiments, and by the same processes, has succeeded in producing continuous films, which he determined to be only the one two million seven hundred and ninety-eight thousandth ($\frac{1}{2798000}$) of an inch in thickness, or ten thousand five hundred and eighty-four (10,584) times thinner than an ordinary sheet of printing paper, or sixty (60) times less than a single undulation of green light. The weight of gold covering 20 square inches is, in this case, thirty-five thousandths ($\frac{35}{1000}$) of a grain; one grain being sufficient to cover nearly four square feet of copper. As you see, the film is perfectly transparent and continuous, even in thickness, and presents all the characteristics of the one shown before. That a portion of the image appears darker, is due to superposed films, the intensity of the green colour being proportioned to the thickness through which the light passes. These experiments will give new interest to the question of the cause of gold appearing green by transmitted light.—*Journal of the Franklin Institute.*

A COMPLICATED WATCH.

THE Geneva *Continent* says:—"We had the pleasure of inspecting the other day the most wonderfully complex and ingenious watch it has ever been our lot to behold—the most complex, it is said, ever produced in Geneva. This watch is a full-sized 'hunter.' On one side is a dial with the ordinary marking (hour, minute, and second hands) together with a large independent chronographic hand in the centre, marking the one-fifth of a second and flying back to XII., to this dial corresponds a repeating mechanism, striking hours, quarters, and minutes. If the watch be turned over, a second dial is perceived, having, besides the ordinary marking, a perpetual calendar (months, days of the week, date, and phases of the moon), and also a little regulator for the timing. This watch can keep two different times, for instance, Paris on one side and London on the other, while there is only one knob on the stem for setting both dials to time without the addition of a pusher on the rim of the case. The mechanism for setting the hands to time actuates only the finger of the dial that is uppermost at the moment, *i.e.*, of the one at which you are looking. We can hardly give, by mere description, an idea of the other qualities and capabilities of this remarkable watch. It has been made to the order of Baron Nicolics, and has taken nine months to make, which is considered a remarkably short period for so intricate, and at the same time so perfect a piece of mechanism.

ARTIFICAL GEMS.

What we popularly call paste is technically known as strass; this is also the French word for the same substance (from M. Strass its reputed inventor). Paste, then, is a material with which diamonds are imitated, and by mixing up with it metallic oxides of various kinds, colours in great variety are imparted to the paste, by which it serves as a representative of the various coloured gems. Strass is prepared according to the method of M. Donault who has obtained great proficiency in the art, from silica, potash, borax, and oxide of lead, and sometimes arsenic. Rock crystal and flint consist almost entirely of silica; but as flint generally contains a little iron, the silica obtained from it is liable to have a tinge of colour which is detrimental to the fidelity of the imitation; rock crystal is therefore employed.

The crucible in which the materials are melted claims particular attention, since if the substance of which it is formed contains metallic particles, colour would be imparted to the strass. Hard porcelain and Hessian clay are the best materials for this purpose. When the crucibles are supplied with the proper quantity of ingredients, they are placed in a porcelain furnace, where they are exposed to a steady heat for twenty-four hours and then allowed to cool very slowly so that a kind of annealing goes on. By this means is produced a strass or paste, which after passing through the hands of the lapidary who gives it the form necessary for "setting," presents us with an imitation of the diamond.

Having once produced strass which imitates diamond, all the other gems may be imitated, by mixing with strass various metallic oxides and other substances according to the colour which is desired to produce. Herein is manifested great diversity of opinions, different experimenters advocating different modes of procedure and different ingredients. One experimenter recommends the following ingredients: To imitate topaz, add glass of antimony, precipitate of Cassius, and oxide of iron to the white strass; for ruby add oxide of manganese; for emerald, oxides of copper, iron and chromium, and acetate of copper; for sapphire, oxides of cobalt; for amethyst, oxides of manganese and cobalt and precipitate of Cassius; for beryl, glass of antimony and oxide of cobalt; for garnet, glass of antimony, precipitate of Cassius and oxide of manganese.

M. Donault has given directions somewhat different from the above, but we need not particularize them, as it would carry us into too minute details. We may, however, mention that he produces the imitative rubies by a particular treatment of the composition employed for topaz. This composition is 1000 parts of strass to 40 of glass of antimony and 1 of purple of Cassius; at a certain stage of its preparation it affords an opaque mass, translucent at the edges, and affording thin laminæ of a red colour. One part of this opaque topaz matter added to 8 parts of strass melted in a Hessian crucible, and left thirty hours in a potter's furnace, affords a beautiful yellowish crystal. If this crystal be re-melted by means of a blow-pipe it produces a strass nearly equal to the finest Oriental rubies. The art of producing imitative gems, ingenious as it is, is necessarily a confined one, for as soon as faithful copies of certain jewels are obtained, the object of the art is attained. The object is to deceive the eye, for as M. Dumas remarks, "the most perfect description of strass, if it imitate no particular and identical gem, has no value, because it deceives nobody." There is a less perfect, but a curious mode of producing artificial gems with what are called doublets by a process of cementation. The artificial consists, in this case, of two pieces of white transparent glass, or of crystal, which is cut into two pieces, conjointly so shaped that both together present the external form of the gem about to be imitated. A transparent cement is then formed of Venice turpentine and mastic melted up together in certain proportions, and to the mixture is added a portion of some colouring matter according to the nature of the gem. Carmine, crimson lake, Prussian blue, verdigris, dragons' blood, Spanish annatto, &c., are employed either separately or mixed one with another until the required tint is imparted to the gummy mixture.—*British Trade Journal.*

A Watch.—These Lines are Printed on an old English Watch Card:—

Could but our tempers move like this machine,
Not urged by passion or delayed by spleen;
And true to nature's regulating power
By virtuous acts distinguished every hour.

Then health and joy would follow as they ought
The laws of nature and the laws of thought—
Sweet health to pass the present moments o'er,
And involving joy when time shall be no more.

PRACTICAL INFORMATION FOR THE TRADE.

Aluminum.—In a recent meeting of the Miners' Union, at Freiberg, Professor Winkler described some experiments made to measure the power which aluminum possesses of resisting external influences. Table-spoons made of aluminum, of silver (75 per cent.), and of German silver of best quality, were the subjects of experiment. They were in the same daily use, and were weighed at regular intervals. These spoons were purposely brought into contact with the greatest variety of food, and each time after using were rubbed with soap, washed in hot water, and rinsed with cold water. They were also occasionally washed with a dilute solution of carbonate of soda, so that they were in daily contact with hot and cold acid and alkaline liquids.

In the course of time there was a change in the appearance of the spoons. The aluminum, which at first was a beautiful white, lost its brightness, and acquired a dead, bluish-grey colour; the German silver also lost its brightness, while its colour changed to a disagreeable greyish yellow; the silver stood best, as it only lost its polish, but remained comparatively white. Repeated weighings showed an average annual loss in weight of:

0·630 per cent. for Aluminum.
1·006 ,, ,, German Silver.
0 403 ,, ,, Silver.

So that if it were possible to use them until entirely used up, a silver spoon would last 248 years, one of aluminum, 158 years, and one of German silver, 99 years.

The spoon form was selected merely because it offered the best opportunity for measuring the amount of chemical and mechanical loss in comparison with other metals and alloys tested. The results of these experiments showed that aluminum is not so easily attacked as has hitherto always been supposed, but is more like zinc; and if it could be made at a low price it might be employed for a great variety of purposes.—*Scientific American.*

Cement for Marble and Alabaster.—Stir up to a thick paste by means of a solution of silicate of soda (water glass), 12 parts Portland cement, 6 parts prepared chalk, 6 parts fine sand, 1 part infusorial earth. It is not necessary to apply heat.

Glue which will Unite Polished Steel.—The following is a Turkish receipt for a cement used to fasten diamonds and other precious stones to metallic surfaces, and which is said to be capable of strongly uniting surfaces of polished steel, even when exposed to moisture. It is as follows:—Dissolve five or six bits of gum mastic, each the size of a large pea, in as much spirits of wine as will suffice to render it liquid. In another vessel dissolve in brandy as much isinglass, previously softened in water, as will make a two-ounce phial of strong glue, adding two small bits of gum ammoniac, which must be rubbed until dissolved. Then mix the whole with heat. Keep in a phial closely stopped. When it is to be used set the phial in boiling water.

To Soften Vulcanite.—Vulcanized india-rubber if placed in nitrobenzine, will at the end of a few weeks become soft and flexible.

Method of Giving a Good Face to Bronze.—The oxidation of statues and other articles in bronze has always been a matter of uncertainty, while the changes which take place in the appearance of such works, either greatly improve or deteriorate works of art. Many bronzes exposed to the action of the air of towns, frequently assume an unpleasant blackness, which makes them resemble cast-iron rather than bronze. The Berlin Society for the Encouragement of Industry has, during the last five years, made many experiments in the oxidation of bronze. An immense number of experiments have been made on oxidized coins, and other objects, and one fact said to be arrived at is that the composition has little to do with the the colour of the oxidation. It has been observed, at the same time, that in the case of public monuments in bronze, those parts which were within reach of the public fingers became admirably coloured, while the other portion became black and unsightly, hence the idea that the *patin*, as the French call this oxidation, was the result of *patinage*, or, in plain English pawing, an inference very difficult to admit in many cases. However, following this indication, experiments have been made with bronze busts placed in the open air, and it has been found that those which were washed daily became an unsightly dark colour, while others which were oiled once a month, the oil being simply wiped off with a woollen rag, became of a magnificent tone.—*New York Jewellers' Circular.*

THE ENGLISH HALL MARK ON FOREIGN WATCH CASES.

A MEETING of London watch-case makers was held on the 10th ulto. at the Crown Tavern, Clerkenwell Green, for the purpose of receiving a deputation from Liverpool, appointed to confer with the case-makers of Clerkenwell on what the circular announcing the meeting called the "insidious and fraudulent practice known and tolerated by the English Government" of English Hallmarking Swiss-made watch-cases. The chair was occupied by Mr. Wolfe, who introduced Mr. Geoffery Benson and Mr. William Beagles, the deputation from Liverpool.

In the course of his observations the Chairman called attention to a long Correspondence which had taken place between the Goldsmiths' Company, the Clock Makers' Company and the Board of Trade, which correspondence was forwarded to Mr. John Bright, M.P., who wrote the following reply:—"Rochdale, August 28, 1877.—Sir,—I have read the correspondence you have sent me. The answer given by the Board of Trade is the one which presented itself to my mind when I heard of your grievance, and I am bound to say that I think your reply is not conclusive. There is no proof that gold watch-cases can be made more cheaply abroad than in England—the material is dear in one country as in the other—whether you speak of Switzerland or America. You say your workmanship is better than that of the foreigner; and, if this be true, surely you can make watch-cases as cheaply as they can be produced abroad. The Board of Trade do not believe that an Act of Parliament would be of any use to you, and I incline to be of the same opinion. To insist on declarations such as you wish for is not well, unless the grievance is real and important, and the remedy certain. I cannot give any promise as to this matter except this, that I shall be glad to ascertain the truth about it, and to give it a full consideration, if any bill on the subject should be introduced into the House of Commons. I am, respectfully yours (Signed), JOHN BRIGHT.—Mr. Walter Mackintosh, 12, Ryder Street, Wavertree Road, Liverpool."

Mr. Benson thought it was evident from the letter that Mr. Bright had not grasped the subject at all. All Englishmen wanted to do was to protect the Hall-mark; but if they could not do that let them do away with the Hall-mark altogether. Their object in meeting there that evening was to bring about a combination of British workmen to solicit the aid of members of Parliament connected with the towns where the trade was carried on in putting a stop to this practice.

Mr. Bennett expressed his opinion that it was a fraud to sell foreign articles as home produce; for by so doing the foreigner was stealing away the reputation of the English artisan. This was not a question of free trade; and, not being so, the Government was bound to protect and assist the British workman.

Mr. Beagles also addressed the meeting at some length; and, after some further speakers had addressed the meeting, a resolution was unanimously passed to the effect that watch case makers of London pledge themselves to co-operate with the trade of Liverpool and Coventry in securing a removal of the grievance complained of.

The proceedings terminated in the usual manner.—*Standard.*

In reference to the above the *Times* says:—

A somewhat protracted correspondence, of which the following is a summary, has been carried on between the Board of Trade, the Goldsmiths' Company, and the Clockmakers' Company, with regard to the practice which, as will be seen from correspondence we have been and are publishing, has of late much increased, of sending Swiss or American watch-cases to England to be Hall marked. In the case of foreign goods sent as such the letter "F" would be stamped upon them, but the first letter from the Clockmakers' Company complains of the practice resorted to by certain members of the trade of stamping foreign made cases with their own registered punch, and then sending them to the Goldsmiths' Hall to be stamped with the English Hall mark. As such cases, together with the works contained in them, are sold as English manufactured, the Goldsmiths' Company suggested that persons sending such cases in should be required to make a statutory declaration that they were wholly of English manufacture, failing in which they would be stamped with the "F." A letter was accordingly sent to the Committee of the Council of trade suggesting that an Act of Parliament should be obtained to enable this proposal to be carried out. In reply to this the Secretary of the Board of Trade says:—"In thanking you for your communication, I am to state that my Lords, before expressing their opinion upon the suggestions now made by the Wardens of the Goldsmiths' Company, would be glad to be favoured with the views of the Wardens as to how far such a step would be really efficacious in removing the alleged grievance of the English watchmakers. The assumption is that English-made works are superior to those of foreign manufacture, and that the foreign makers, by getting their cases stamped at the Goldsmiths' Hall, induce the English public to believe that their foreign works are of English manufacture. If this is really the case, and if the foreign manufacturer does reap an advantage thereby, what is to prevent his putting his foreign work into English made cases?" In reply to this, the Clockmakers' Company say that it is clear that the object of the foreign manufacturer in having the cases Hall-marked in England is to palm off the work as English made. The reason for not using English made cases is that the cases can be made much cheaper abroad than in England. Moreover, it is much easier and less expensive to make the case to the works than the works to the case, and the cost of doing this in England would be, to a great extent prohibitory of the practice. These views having been laid before the Board of Trade, they have replied that after careful consideration of the subject, they do not think that it would be advisable for the Government to undertake to submit to Parliament a special Bill requiring a statutory declaration to be made as to the origin of watch cases when taken to assay offices to be stamped.

MISUSED WORDS.

JEWELLERY.

MANY women, and some men, who should know better, are in the habit of speaking of their jewellery when they mean their jewels. The words thus used is of very low caste. Think of Cornelia pointing to the Gracchi and saying, "These are my jewellery," or read thus a grand passage in the last of the Hebrew prophets: "And they shall be mine, saith the Lord of Hosts, in that day when I make up my jewellery!" As applied to trinkets and precious stones, the word means, at best, jewels in general, not any particular jewels. It is of very late introduction in any sense; not being in Shakespeare, or the Bible, or Milton, or Johnson's Dictionary. The earliest authority quoted for it by Richardson is Burke, who speaks of "the jewellery and goods" of India. But properly, jewels are no more jewellery than shrubs are shrubbery, slaves slavery, or beggars beggary. Jewellery is properly the name of the place where jewels are kept, as slavery is the name of the condition in which slaves are kept, as beggary is that of the condition in which beggars are, and as shrubbery is that of ground filled with shrubs. These words belong to a numerous class ending in ry, which express place, or condition, which is moral place. Such are belfry, library, laundry, bakery, buttery, aviary, grocery, pottery, armoury, infirmary, bindery, confectionery. From grog we have rightly formed groggery, and our translators of the Bible, called Judea, the place of the Jews, Jewry. Now we might as well call a knot of Jews Jewry, or whisky toddy and rum punch groggery, as a set of jewels jewellery. But jewellery is one of a few of these words which have been perverted by carcless speakers. Such are confectionery, pastry, and crockery. Confections are made by a confectioner, and kept in a confectionery; paste is kept in a pastry; and crocks, made by a crocker, are kept in a crockery. All these words have been thus correctly used. We have the proper name Crocker, derived from the occupation, like Baker or Baxter, Webster, Webber, or Webb, and Fuller: and Howell (to bring forward one out of numberless examples) tells us in one of his letters, that Felton, the murderer of the Duke of Buckingham, in his attempt to escape, "was so amaz'd that he miss'd his way, and so struck into the pastry, where"—he was arrested. The perversion of jewellery, confectionery, pastry, pottery, and crockery is probably due to the substitution of signs inscribed with words for those first used, which were merely decorated with some device or sign—whence the name. The jeweller put up "jewellery" over his shop door, and the crocker "crockery," and so forth: and these names of places were at last misapprehended as names of articles for sale in those places. As crock passed out of use as a general name, (although no one now-a-days has any difficulty in understanding the title of the story of the "Crock of Gold,") crockery was the first, and is the best established of these perverted words. Next comes confectionery, although confections is not quite out of use, and might be easily restored; and the common use of paste, pot, and jewel leaves no excuse (except conformity to a bad custom which perverts meanings, cramps language, and violates analogy) displacing them in favour of pastry, pottery, and jewellery.—"Words and their Uses," by RICHARD GRANT WHITE.

PROFESSOR LANGLEY'S APPARATUS FOR ELIMINATING PERSONAL EQUATIONS.

PROFESSOR S. P. LANGLEY describes, in the *American Journal of Science and Arts*, a new and very ingenious apparatus for eliminating the "personal equation" on the star itself. It is constructed and operated as follows:—

On the transit pier (or in any other convenient locality) is a small clock, with a conical pendulum, whose bob slides freely up and down the graduated rod, retaining its position where left. A small horizontal wheel in the clock is controlled by the pendulum, and turns once for a certain constant number of its revolutions. This wheel revolves once for each equatorial interval of the transit wires, when the bob is set at a mark near the top of the rod, and by sliding the bob sufficiently downward—with the use of a readily constructed table, we can, given the declination of any star between the limits 0° & $\pm 60^\circ$, set the pendulum, so that this wheel shall make exactly one revolution while the star passes from wire to wire. This wheel carries near its periphery a mercury drop or other contact piece, which once in a revolution is carried past a point fixed near the periphery of a stationary horizontal wheel, concentric with the first, and immediately above it, but insulated and entirely detached from it.

This upper wheel, while thus related to the lower, is entirely disconnected from the machinery of the clock, and is thus far stationary; but it can be revolved by cords passing from a groove in its circumference to the hand of the observer at the transit. As the upper, or ordinarily fixed, and the lower, or constantly moving, wheels have a common vertical axis of revolution, and as the radial distance of the point in the upper from this axis is the same as that of the contact piece on the lower, it will be seen, while the upper wheel remains motionless, electric contact accompanied by a simultaneous flash, if we desire it, at the transit lantern or elsewhere, will be made at equal and uniformly recurrent epochs, the interval between which depends only on the adjustment of the pendulum. If the upper wheel be rotated forward by hand through a small distance and then left, the next contact will still occur, but at a later epoch, owing to the lower wheels having to complete more than one revolution to make contact, but after this the contact and simultaneous flash will recur at the same intervals, and with the same regularity as before. If the upper wheel be moved backward the flash will occur once, earlier, and thereafter with regularity. Moving the upper wheel, then, changes the epoch from which any series of such flashes dates, and adjusting the pendulum bob fixes the interval between subsequent flashes. In practice the lamp is removed from the transit lantern, and the two terminals of a battery or induction coil in its place cause the flash to be thrown upon the wires, whenever the mercury drop is in contact with the point, and at the same instant a mark is made automatically on the chronograph, and interpolated in the regular record of the beats of the sidereal clock, which go on in the usual way quite independently of any reference to the apparatus just described.

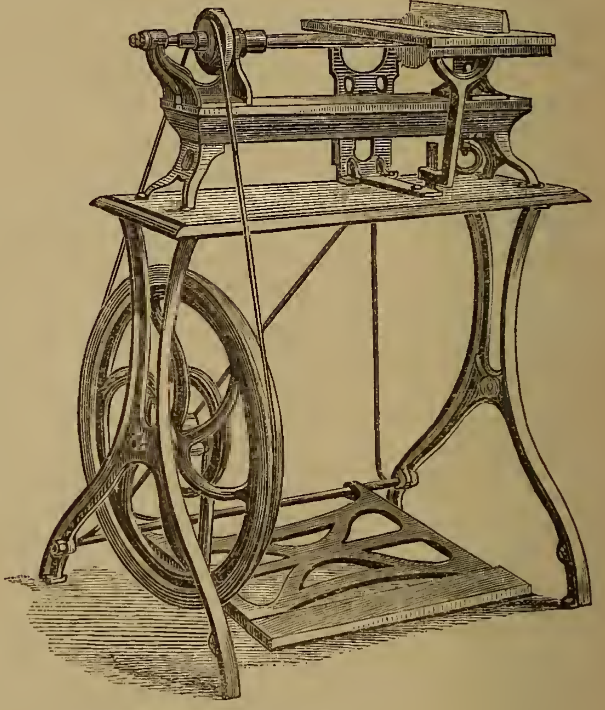
The mode of observation will be anticipated. Before the transit of any star the observer adjusts the conical pendulum beside him (this is the work of but a few seconds), and then seats himself at the instrument, holding the cords in one hand like the "reins" of an equatorial. If a flash occur just as a star is crossing the first wire (which is most unlikely) he has nothing to do except possibly to note which was the middle wire, for each records itself in the chronograph without any intervention of his. But if the star be, for instance, two-thirds of the way from the first to the second wire at the first flash, he will draw one of the cords, accelerating the flash, and thus causing the star to appear nearly coincident with the second wire when the next spark comes, and repeat the adjustment by the light of subsequent flashes, till the bisection is perfect. Three or four trials are in practice found to yield a bisection which will satisfy a fastidious eye, and when a satisfactory one has been once made, the effect is automatically repeated.

Under the general conception, then, of the possibility of diminishing, to any limit, personal error, by employing brief views of the star or wire and utilizing the phenomena of persistence of vision, the particularly described device assumes to dispense with the observer's record upon the chronograph altogether, and to substitute a purely automatic one giving the same virtual result as though the image of the star were a tangible object, itself making electric contact with each wire. The share of personality in any observation is relegated to the prior act of bisecting a star, virtually motionless with relation to the bisecting wire, so that if (as seems to be the case) this act is independent of quickness or slowness of perception, of the time of cognition, or of the speed of nerve transmission; personality, in the technical sense, appears not to intervene at all.

FOOT LATHES AND OTHER TOOLS.

THE development of a taste for the mechanic arts has been very marked within a few years past. Students, clergymen, gentlemen of leisure, and others of sedentary habits, have sought relaxation from mental and physical strain in this to them agreeable recreation. That which to the mechanic is wearisome, through its necessity, readily becomes a pleasant, and at the same time useful pastime. Many of our most active business men have a workshop fitted up at their homes, in which some of the most costly tools are kept, and where after the toils of a day's business they can unbend their minds and relax their muscles in fashioning some tasty article as a gift to their family or friends. Such gifts are appreciated the more, both by the giver and by the recipient, for the reason that they are the result of hours of patient labour.

The most important of the tools required in developing this taste—in fact the first and only *necessary* one—is the and in the above illustration we show an improved lathe manufactured by Messrs. J. G. Weisser, Söhne, of Baden and which, by means of proper appurtenances can be adapted to an almost unlimited variety of uses.



TURNING LATHE.

To turning articles of wood or iron of every conceivable shape to drilling, to engraving, to sawing, and in fact to almost every description of work. "Where the necessary motive power cannot be obtained otherwise, the operator can supply it by means of foot power, and the manufacturers of these foot-lathes seek to supply in the beautiful instrument they present, a want, in this respect, long felt. Foot-turning lathes have hitherto been supplied; but in consequence of the care and expense necessary to make them perfect, those heretofore sold have either been so inferior or at such exorbitant prices, as to prevent the masses adopting them. By devoting a factory almost exclusively to their manufacture, supplied with expensive machinery and by employing the most skilful workmen under the most careful supervision, Messrs. Weisser have succeeded in producing at a moderate price, foot-turning lathes (interchangeable in all their parts) of the finest workmanship and exquisite beauty of style and finish at a reasonable cost. This assertion is concurred in by those who have examined them, and while we call thereto the special attention of those with whom their use could be a luxury, we do not overlook the great want felt by thousands of mechanics throughout the country, for a closely-made perfect turning-lathe, at a moderate cost. To such the manufacturers, Messrs. J. G. Weisser Söhne, St. Georgen Baden, will be glad to give full information as to the material workmanship and details of the lathe.

While the simple lathe is adapted to a great variety of work its usefulness is increased ten-fold by the addition of the following appurtenances.

The Circular Saw.

This important adjunct in the working of wood consists of a finely-finished hard wood table made of five pieces which are firmly dowelled and glued togther. By this method we are enabled to prevent all warping of the wood. It has a steel mandrel which runs in a cast iron frame, and is attached to the spindle of the lathe by a coupling which is easily and quickly adjusted. There is also connected to the frame an iron brace, one end of which is hinged to the table and the other moved through a slot and held at any desired angle by the tightening of a thumb-screw, thus enabling the operator to do rabbetting and all kinds of sawing necessary in making picture frames, puzzles, &c. Two saws can be furnished, one for splitting and one for cutting off; the table has also two guides, both of which move in slots and at right angles. One bolt running from the cast iron frame to the bottom of the lathe bed firmly secure the whole combination.

The Scroll Saw.

This is an attachment which enables the operator to saw out any variety of scroll-work for brackets, inlaid and other ornamental work. It is a frame standing vertically upon the lathe, and can be quickly adjusted. The motion to the saw is given by a wrist-pin attached to the lathe-spindle. The stroke is about two inches. Although it is not recommended for heavy work, it will saw through wood of two or three inches thick and is considered a very useful attachment.

ELECTRIC ASSAY OF MANGANESE, NICKEL, ZINC, AND LEAD.

MONS. ALF. RICHE gives the result of his experiments in the *Comptes Rendus* of the 23rd of July. He says:—"I have already had occasion to show that copper can be estimated with the greatest accuracy in nitric acid solution by the action of the pile. I also have recourse to the electric current for estimating manganese, nickel, zinc, and lead."

I. *Manganese.*—*a.* If the liquor contains only this metal, in the condition of a sulphate or nitrate, it is submitted to the action of a Bunsen element, or a couple of elements, when the manganese is in small quantity. This operation is carried out in a platinum crucible kept at a heat of 70° to 90° C. in a water bath. The manganese is deposited as a binoxide on the crucible which forms the positive pole; the negative electrode is a platinum spiral. When the liquor is clear of manganese it is decanted in a filter, which is washed and incinerated in the tared crucible; 250 milligrammes of oxide are deposited in five hours. The operation would be slower if conducted cold; it would be accelerated by using three elements; 750 milligrammes are then thrown down in eight hours. The sensitiveness of the method is shown by the following tests:—

(1.) Fifty cubic centimetres of liquor yielding by calcination, ½ milligramme of oxide of manganese was submitted to the current. The positive pole was coated with a binoxide, and the liquid, when decanted and submitted to evaporation, was not coloured when heated with carbonate of soda.

(2.) This same test was made use of to re-open a question still in dispute, namely, the existence of manganese in the blood. I cite one experiment only. Blood from which the fibrine was removed was taken, and two portions of 500 grammes each were weighed. One of these was incinerated, to the other was added beforehand 1 cubic centimetre of a titrated liquor yielding 1 milligramme of oxide, Mn_3O_4. The first gave less than 1 milligramme of oxide; from the second were got 1·5 to 2 milligrammes.

(3.) A liquor containing less than the millionth of a gramme changed, cold, to a very perceptible rose colour under the action of the current, the coloration being perceptible with a dose tenfold diluted.

(*b.*) The manganese is got at with equal exactitude in presence of copper, nickel, cobalt, zinc, magnesium, aluminum, and the alkaline, and alkaline earth salts. It cannot be determined if accompanied by a large proportion of iron. The binoxide behaves as in glass working; it is reduced to the state of a proto-salt which remains in solution. It is therefore indispensable to precipitate the iron with carbonate of baryta, and submit the filtrated liquor to the current.

II.—*Nickel.* I have often taken the pile into use for assaying ores from New Caledonia containing nickel and magnesia, and some times cobalt and manganese as well. Up to the present time it was considered sufficient to determine the nickel by precipitation in an ammoniacal liquor, but this metal often brought magnesia with it to the negative pole. The latter is got rid of by dissolving the deposit in nitric acid; then treating with sulphuric acid, and exposing the liquor to the current from a couple of elements, which throws down the nickel in a state of purity.

III.—*Zinc.*—*c.* A nitric or sulphuric acid solution of this metal is taken and saturated with ammonia, so as to re-dissolve the precipitated oxide; an excess of nitric acid is then added. This liquor exposed cold to the action of a couple of clements, gives a deposit which adheres strongly to the negative pole, which is formed of a cylinder or leaf of platinum tared beforehand.

d. Brass can be tested in a few hours by this process. The liquor is submitted warm to the action of one element, the copper is separated by itself at the negative electrode. The latter being removed, the iron in the liquor is precipitated with ammonia, and the zinc is deposited with two elements in this filtered liquor, as stated in the preceding paragraph, the tenth of a milligramme is precipitated in a few moments.

IV. *Lead.*—*e.* If this metal occurs by itself in a nitric acid solution, it is exposed, cold or hot, to the action of one element. The whole amount of binoxide of lead is deposited in the form of a very tenacious coating on the crucible, which forms the positive electrode. The liquor is decanted by the siphon without stopping the current, then replaced by water, which is decanted two or three times, and the tared crucible is dried at about 100°C., then weighed. In five hours 400 milligrammes are deposited, and 2 grammes in a night. The lead in a liquor which only contains two-hundredths of a milligramme can be plainly seen deposited on the walls of the crucible.

The assay of bronzes—alloys which commonly contain tin, copper, and small quantities of zinc, lead and iron—become, if regard be had to the facts stated above, a rapid operation, in which three of these metals are determined without filtrations or evaporations, by weighing a tared plate of platinum, whereas this assay used to require a long and delicate series of manipulations, and the determination of zinc in the dry way a high temperature, prolonged for a considerable time. The metastannic acid being separated, the copper and lead are precipitated at the same time with one element, the iron is separated by ammonia, and the zinc is determined in the filtered liquor by means of two elements.

AUTOMATIC STOP FOR CHRONOMETER ESCAPEMENT.

IT is necessary to stop the movement of the escapement wheel when the balance is taken out, but, however slightly the detent may be touched in the operation, the wheel is disconnected and in begins to run with great rapidity until the detent falls back in its place. From the force acquired by the wheel, the rest will be broken, a tooth of the wheel bent or the detent spring pushed back, according to the relative strength of the parts. Very often all these parts are injured and the author of the mischief sometimes only increases it in endeavouring to repair the damage.

In order to avoid this danger, some watchmakers place a screw, from which a part of the head has been taken off, near the circumference of the wheel; this screw being a little bent will fall in between the teeth. Others use a screw bearing an eccentric pin which produces the same effect. These little expedients are scarcely ever employed, however, because a person who understands the detent escapement can as easily put a little paper or wood in the wheel as turn the screw, while the larger number of those who do not know the management of a chronometer, do not use the screw, as they do not understand its purpose.

The following arrangement will render such accidents impossible: A spring is screwed to the hollow side of the pillar-plate so as to be parallel to the length of the cock. The thin part of the spring is near the foot, the full receives a pin which passes freely through a hole of the pillar-plate and which is placed so as to be covered by the foot of the cock. The full part of the spring is prolonged to the circumference of the wheel, and at this point carries another pin. The extremity of the first pin is a little above the surface of the pillar-plate and the second enters between the teeth of the wheel, which can then only move the distance from one tooth to another, even when the detent is entirely removed. When the cock is put in its place, it pushes down the first pin to the level of the pillar-plate, and the bending of the spring which results makes the second pin fall to a sufficient distance from the wheel.—*American Jeweller, Silversmith and Watchmaker.*

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SPECIAL NOTICE.

TO WATCHMAKERS AND JEWELLERS—For disposal, an old established highly respectable business well situated in one of the best thoroughfares in the city of Bristol. For particulars apply to W. H. Williams & Co., General Agents, Exchange, Bristol.

Errata in Last Number.

Page 51 read Metallurgical for Metallingical.
„ 51, 50 „ null „ well.
„ 51. D. Quare died 30th March, 1724, and not 19th March, 1775. Graham died in November, 1751, and not 1725. Quare could therefore not have been successor to Graham.
„ 54 read Bunting, 1632, for Banting, 1631.
„ 56 „ Lehrbuch instead of Lelubuch.

Prices Current for Gold and Silver—Value Given for Old Gold and Silver by Assay. Fine Gold, 84s. per oz. Fine Silver, 4s. 8d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3 d. per oz. Fine Silver, 5s. 3d. per oz. Standard Silver, 4s. 8d. to 4s. 10d. (variable.)

An Easy Silvering Process.—Chloride of silver in paste, 8; Chloride of sodium, 1; Carbonate of calcium, 1; Carbonate of potassium; If well mixed it will suffice to rub the copper article with a little of this powder, after having been carefully cleaned.

To Temper Small and Brittle Pieces Without Injuring Them.—Monsieur Cadot of Paris, recommends the following method. The part is red-heated (according to the nature and quality of the steel) in a small iron-shovel and then gently dropped on an iron or steel plate, which must be at least a centimetre thick. It is then quickly covered with another plate of the same thickness. It is essential that the plates be well dressed and cold. If properly conducted this operation will give highly satisfactory results.—*Révue Chronométrique.*

Pottery and Glass Trades Review is a new monthly publication devoted to the interests of the above trades, and, judging from the first three numbers before us, we feel sure that it will be a welcome boon to all those interested in the trades it represents. It is replete with practical and useful information, and interesting alike to the trader and the artist. Its list of contributers includes names which will secure for it a high rank among "trade journals." At the same time its outward form has not been neglected, and type and illustrations leave nothing to be desired. The current number contains "Notes on Art Pottery and Porcelain;" "The Liverpool Art Gallery;" "The Pottery and Glass Trades of Russia," a very interesting paper on the "History of Enamels;" "The Chasse of St. Mark at Huy, with Illustration," &c.

PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

3420. Peter Jensen, of Chancery Lane, London, for an invention of "Improvements in chronometer mechanism for compensating for mean and extreme temperature."—A communication to him from abroad by August Ernst Müller, of Wolfsgraben, near Vienna, Austria.—Dated 10th September, 1877.

3444. Auguste Lion, jeweller, of the city of Paris, in the republic of France, for an invention of "Improvements in the manufacture of bracelets."—Dated 12th September, 1877.

3540. Richard Hooper Allen, of Handsworth, in the county of Stafford, jeweller, for an invention of "An improved fastening for solitaires, applicable also for purses, bags, and other like articles."—Dated 20th September, 1876.

3605. William Frederick Spittle, of Birmingham, in the county of Warwick, Manager of Works, and William Pearce, of Handsworth, in the county of Stafford, Manufacturing Jeweller, for an invention of "Improvements in solitaires, sleeve links, and other like fastenings."—Dated 26th September, 1877.

3627. George William Ambridge, of 2, Myrtle Street, Hoxton, London, N., Philosophical Instrument Maker, for an invention of "An improved kaleidoscope."—Dated 27th September, 1877.

Notices to Proceed.

1624. Joseph George Rollason, of the firm of Rollason, Wood, & Co., stampers, piercers, and fancy chain manufacturers, of Birmingham, in the county of Warwick, has given notice in respect of the invention of "Improvements in sleeve-links and other dress-fasteners, which improvements are also applicable to other purposes."

1639. Henri Adrien Bonnefille, of the British and Foreign Patent Offices, 18, Rue de la Chaussée d'Antin, Paris, France, and 6, Piccadilly, in the county of Middlesex, Patent agent, has given notice in respect of the invention of "Certain improvements in self-recording thermometers, hygrometers, and other instruments of a similar nature."—A communication from Robert Kirk Boyle, a person resident in the city, county, and state of New York, United States of America.

3258. Narcisse Salmon and Albert Delaviere, both of Paris, in the republic of France, have given notice in respect of the invention of "Improvements in shirt or sleeve studs, solitaires, and other analogous articles."

1766. Samuel Padley, of 29 & 31, Well Road, Heeley, in the parish of Sheffield, county of York, silversmith, has given notice in respect of the invention of "Improvements in the manufacture of urns and other vessels employed for heating liquids."

1880. Johann Anton Benedict von Castelberg, of 58, Holborn Viaduct, in the city of London, has given notice in respect of the invention of "Improvements in watches."—A communication to him from abroad by Cécile Domon, of Bienne, Switzerland.

1932. Arthur Charles Henderson, of 6, Southampton Buildings, Holborn, in the county of Middlesex, Patent Agent, has given notice in respect of the invention of "Improvements in watches."—A communication to him from abroad by Julien J. B. Joseph Lebas, watchmaker, of Willerval, in the department of Pas-de-Calais, in the republic of France.

Grants of Provisional Protection for Six Months.

3137. To Henry William Ley, of Bear Street, in the county of Middlesex, for the invention of "Improvements in clocks."

3223. To Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for the invention of "Improvements in decolorizing and colouring pearls."—A communication to him from abroad by Joseph Marie Clément, of Paris, France.

3420. To Peter Jensen, of Chancery Lane, London, for the invention of "Improvements in chronometer mechanism for compensating for mean and extreme temperature."—A communication to him from abroad by August Ernst Müller, of Wolfsgraben, near Vienna, Austria.

3444. To Auguste Lion, Jeweller, of the city of Paris, in the republic of France, for the invention of "Improvements in the manufacture of bracelets."

3456. And to Bernhard Turgen Friedrich Voss, Captain, in the city of Hamburg, Germany, for the invention of "Improvements in reflecting instruments for taking celestial altitudes."

Patents Sealed.

1511. Albert Barker, of New Bond Street, in the county of Middlesex, dressing case maker and silversmith, for an invention of "Improvements in keys for locks, latches, watches, clocks, and other like articles, applicable also to cocks or taps."—Dated 18th April, 1877.

1580. **Albert Barker**, of New Bond Street, in the county of Middlesex, silversmith and dressing case maker, for an invention of "Improvements in pencil-cases, pen-holders, tooth-picks, and other similar articles, such improvements being also applicable to necklets and bracelets."—Dated 23rd April, 1877.

1094. **Arthur Charles Henderson**, of 6, Southampton Buildings, Holborn, in the county of Middlesex, Patent Agent, for an invention of "Improvements in the application of alarms to watches."—A communication to him from abroad by Frederick Dessert, watchmaker, a person resident at the Besançon, in the department of Doubs, in the republic of France.—Dated 19th March, 1877.

1122. **George Blunt**, of 24, Augusta Street, Birmingham, in the county of Warwick, jeweller, for an invention of "Improvements in fastenings for solitaire sleeve studs, and other articles of a similar kind."—Dated 21st March, 1877.

Patents on which the Stamp Duty of £50 has been Paid, and Dates of their Production for Certificate.

3033. **Jacob Baynes Thompson**, of Whitehall, Wraysbury, in the county of Bucks, for an invention of "Improvements connected with the process of coating steel, iron, and cast iron with gold, silver, and other metals or alloys."—Dated 4th September, 1874.

Patents which have become Void.

3114. **Henry Negretti** and **Joseph Warren Zambra**, both of Holborn Viaduct, in the city of London, metereological instrument makers, for an invention of "Improvements in thermometers."—Dated 10th September, 1874.

3221. **Henry Garner Pendleton**, of Birmingham, in the county of Warwick, Jeweller, for an invention of "Improvements in fastenings for solitaires, studs, sleeve links, and other articles of jewellery."—Dated 21st September, 1874.

Patents Granted in Foreign States.

UNITED STATES OF AMERICA.

7660. H. A. **Lugrin**, of New York, U.S.A., for "Stop watch."—Dated 16th July, 1877.

188,177. G. **Pitts**, of Providence, R.I., assignor of two-thirds of his right to J. L. Mason & G. L. Mason, for "Sleeve-buttons and studs."—Application filed 9th February, 1877.

188,246. J. **Johnson**, of Lowell, Mass., for "Spectacles."—Application filed 26th August, 1876.

188,261. A. T. **Robinson**, of Bristol, Conn., assignor to Geo. A. Jones, of the same place, for "Clock-cases."—Application filed 25th October, 1876.

188,267. L. **Towne**, of Providence, R.I., for "Studs and Buttons."—Application filed 5th January, 1877.

188,323. **Louisa A. Weed**, of Brooklyn, N.Y., for "Ear-rings."—Application filed 3rd June, 1876.

188,757. A. **Schwerter**, of New York, N.Y., for "Tools for opening jewels."—Application filed 12th December, 1876.

188,769. **Alex. Beckers**, of New York, N.Y., for "Stereoscopes."—Application filed 8th February, 1877.

188,864. **Henry J. Davies**, of New York, N.Y., for "A combined clock and mirror."—Application filed 17th January, 1877.

188,865. **Henry J. Davies** & **Walter D. Davies**, of New York, N.Y., for "Alarm-clocks."—Application filed 14th February, 1877.

188,901. **Henry H. Hempler**, of Washington, D.C., for "Eyeglasses."—Application filed 3rd February, 1877.

189,042. **Louis P. Juvet**, of Glen's Falls, N.Y., for "Time-globes."—Application filed 15th September, 1876.

189,103. **Ira H. Johannes**, of Washington, D.C., assignor of one-half of his right to R. T. Waters, of Baltimore, Md., for "Eyeglasses."—Application filed 26th February, 1877.

7594. J. W. **Williams**, of New York, N.Y., for "Lock-work attachments for clocks."—Patent No. 183,094, dated 10th October, 1876.—Application filed 12th March, 1877.

189,307. B. **Frese**, of Chicago, Ill., for "Roller-abstractors for watches."—Application filed 29th May, 1876.

189,511. **John S. Spencer**, of New York, N.Y., for "Eye-glasses."—Application filed 7th June, 1876.

189,533. **Wm. Wallace**, of Ansonia, Conn., and L. L. **Smith**, of Passaic, N.J., assignors to Wallace & Sons, of Ansonia, Conn., for "Processes and apparatus for electro-plating wire."—Application filed 5th February, 1877.

189,950. **Adolph Moser**, of Aix la Chapelle, Prussia, for "Telescopes."—Application filed 10th October, 1876.

190,058. J. H. **Marvil**, of Laurel, Del., for "Watchmen's time-detecters."—Application filed 21st March, 1877.

AUSTRIA.

61. A. E. **Müller**, of Wolfsgraben, for "A chronometer system with primary and secondary compensation for all kinds of watches."—1 year.—(Secret.)—Dated 29th April, 1877.

47. V. **Popp** and **Resch**, of Vienna, for "Improvements in pneumatic clocks for towns."—1 year.—(Secret.)—Dated 7th May, 1877.

BELGIUM.

42,743. A. **Lion**, for an imported invention of "A novel kind of bracelets."—Dated 2nd August, 1877.—(French Patent, 22nd November, 1876.)

42,748. W. H. **Bracy**, T. **Kyle**, & B. **Wormelle**, for an imported invention of "An improved remontoir for watches."—Dated 3rd August, 1877.—(French Patent, 2nd August, 1877.)

42,796. H. M. **Robottom**, for an imported invention of "Improvements in keyless watches."—Dated 10th August, 1877.—(English Patent, 17th July, 1876.)

42,993. A. **Michel**, of Tournai, for "A keyless watch."—Dated 31st August, 1877.

43,020. D. **Dutot-Gallerie**, of Brussels, for "A cosmopolite clock."—Dated 5th September, 1877.

SAXONY.

4858. **Junod-Pattus**, of St. Croix, for "A remontoir-watch with repetition."—5 years.—Dated 19th March, 1877.

Patents Granted in British Colonies and Dependencies.

CANADA.

7241. **Ambrose Kent** & **Benjamin Kent**, of Toronto, Ont., for "An instrument for indicating the number of spectacle glasses." (Appareil pour indiquer le numéro des verres de lunettes.)—5 years.—Dated 19th March, 1877.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Joseph, Lyon Joseph, 88, Vyse-street, Birmingham, jewellers' factor. Aug. 28. C. B. Hodgson, sol., Waterloo-street, Birmingham.

Halfhide, George William, 401, New Cross-road, watchmaker. Sept. 5. S. T. Cooper, 88, Chancery-lane.

Pugh, Edwin Talbot, Milldam, South Shields, optician, &c. Sept. 8. W. S. Young, sol., Newcastle.

Morris, Edward, Over-street, Brighton, jeweller. Sept. 10. At Fenner, Hilton, & Gifford's, 2, Gresham-buildings, London, Oct. 5 at 2. T. A. Goodman, sol., Brighton.

Taylor, David, Birstall, Yorks, watchmaker. September 18. At F. S. Wooler's, sol., Batley, October 5 at 10.

Adjudications of Bankruptcies.

Behrens, Louis, trading as J. **Behrens & Son**, 39, Deansgate, Manchester, jeweller. Sept. 6.

Kelly, James, Longford, watchmaker. Sept. 11; sittings, Tuesday, Oct. 9, and Friday, Oct. 26. O. A., C. H. James, sol.

Trustees Appointed.

Furneux, Thomas G. (Liq.), Coventry, watch tool and material dealer. Tr., H. Merrick, Coventry, accountant.

Langman, William H. (Liq.), Derby, watchmaker. Tr., M. J. Rothschild, 15, Caroline-street, Birmingham, watch manufacturer, and S. Hall, Derby, accountant.

Douglas, James, Argyle-street, Glasgow, goldsmith, &c. Tr., J. Miller, 71, Queen-street, Glasgow. Com., H. Davis, watch manufacturer, &c., J. Craig, merchant, and J. Gardiner, 38, Queen-street, all Glasgow.

Ball, George J. trading as **Brugger & Straub** (Bkt.), High Holborn, and Brixton-road, jeweller. Tr., E. P. Wilson, 11, Old Jewry-chambers, Old Jewry, accountant.

Michael, James (Bkt.), 17, Rattray-road, Brixton, jewellers' factor. Tr., L. J. Sharp, Ann-street, Birmingham, accountant.

Frohwein, Jacob Otto (Liq.), Portsea, jeweller. Tr., W. Edmonds, 43, St. James-street, Portsea, accountant.

Reed, Alfred (Liq.), Cambridge, jeweller. Tr., J. Glasscock, Cambridge, High Bailiff of C.C.

Dissolutions of Partnerships.

Griffin & Whitehead, 82, Spencer-street, Birmingham, gold platers. Aug. 25. Debts by Emanuel F. Griffin.

Sangster, Smith & Co., Union-street, Aberdeen, watchmakers. Sept. 13. Debts by Wm. Sangster & Wm. Dunningham, who continue the business as Sangster & Dunningham.

Cox, C. & Co., Christchurch, Hants, watch fuzee chain-manufacturers. August 31.

Moore, Bros., Derby, jewellers. June 23.

Taylor, William & Sons, Great Hampton-street, Birmingham, jewellers. August 24.

Bankruptcies Annulled.

Walton, George Edwin, jun., trading **Walton & Walker** (June 12, 1873), Northampton-street, Birmingham, jeweller. September 21.

THE WATCHMAKER, JEWELLER, SILVERSMITH, AND KINDRED TRADES' DIRECTORY.

The important feature of our Directory Columns will be found to be a most effectual method of keeping the Names of Firms and Manufacturers before the constant notice of the Trade.

No Charge is made for Insertion of a Two-line Entry of Name and Address of Firms whose advertisements, occupying not less than one-third of a page, appear for twelve consecutive months. In other instances, the Charge for the Two-line Entry of Name and Address is £1 1s. per annum; four lines, £1 10s. per annum; six lines, £2 2s. per annum. No Charge is made for the heading or title under which any entry appears.

AMERICAN (WALTHAM) WATCHES.

FATTORINI & SONS (Wholesale Factors) Watch and Chronometer Manufacturers, Bradford, Yorkshire.

BAROMETER AND THERMOMETER MAKERS.

MURRAY & CALLIEU, 22, St. John's Square, E.C.

NEGRETTI & ZAMBRA, Holborn Viaduct, E.C.; Charterhouse Street, E.C.; 45, Cornhill, E.C.; 122, Regent St., W.

WEBSTER, J., 88, St. John Street Road, Clerkenwell, E.C.

BURGLAR AND FIRE PROOF SAFE MAKERS.

CHATWOOD'S, 120, Cannon Street, E.C., and Lancashire Safe and Lock Works, Bolton.

PHILLIPS & SON, Speedwell Works, Sherborne Street, Birmingham.

WHITFIELD (F.) & CO. Whitfield's Patent Screw Bolt and other Safes, Viaduct Works, Oxford Street, Birmingham.

MILNERS' SAFE COMPANY, LIMITED, Phœnix Safe Works, Liverpool. London:—Milners' Buildings, opposite Moorgate Street Station, City, E.C. Manchester:—28, Market Street. Liverpool:—8, Lord Street. Birmingham:—93, New Street. Glasgow:—41 and 43, West Nile Street.

CLOCK IMPORTERS.

MAYER A. & SON, 122a, Aldersgate Street, London, E.C. Importers of American, French, German, and Cuckoo Clocks, Materials, &c.

CLOCK MAKERS.

COHEN (JACOB) & CO., 36 and 37, Ely Place, E.C., and Charterhouse Street, E.C., London; and 10, Rue Béranger, Paris.

GILLET & BLAND, Steam Clock Factory, White Horse Road, Croydon. Exhibition Medal, 1873. Makers (to her Majesty's Government) of Worcester Cathedral Chimes at Bradford and Rochdale Town Halls, Boston, St. Stephen's Church, Hampstead, &c.; and of Clocks of every description; also patent Carillon Machines. Sole Proprietors and Makers of Patent No. 4141, for improvements in Church and other Bell Music. Established 1844.

GREENWOOD (JOHN) & SONS, Importers and Manufacturers of Clocks and Watches. Wholesale and for Exportation. Farringdon Road, near Clerkenwell Green, London, E.C.

GROOM, G., Windmill Road, Croydon, every description of Church, Turret, Railway, Chime, and House Clocks to the Trade.

SWINDEN & SONS, 27, 28 & 29, Temple Street, Birmingham.

DIAMOND MERCHANTS.

JONAS BROTHERS, 34, Ely Place, Holborn, London, E.C.

RUTHERFORD, JAMES, 2, Wilderness Row, E.C., and 33, Kirby Street, Hatton Garden, London, E.C.

WIEGEL, B., Jun., Diamond Merchant and Jeweller, 27, Wilmington Square, Clerkenwell. Diamonds and precious stones mounted or reset to the best advantage. Country Orders punctually attended to.

GILT JEWELLERS.

CARLOSS (W. J.) & KING, 66, Hatton Garden, London, E.C. Manufacturers of Gilt Head Ornaments, Coronets and Combs, Jewelled Gilt Table Ornaments, Flower Vases Inkstands, Prize Cups, and Ornamental Metal Work.

HUTTON & CO., 5 and 6, Newgate Street, E.C., and Phœnix Court, Newgate Street, London, E.C.

JET ORNAMENT MANUFACTURERS.

BLUMBERG & CO., 2, Cannon Street, London, E.C.

JONES, A. EDWARD, 93, Hatton Garden, London, E.C.

LITTEN (T. R.), 64, Hatton Garden, London, E.C.

WILLIAMSON, HENRY, 85, Old Street, St. Luke's, London, E.C.

JEWELLER'S MATERIALS.

CLEMENTS, HANDLEY & Co., Dealers in all kinds of Tools and Materials, Stones, Pastes, Cases, &c., 19, St, John's Square, Clerkenwell, E.C. (*See* advertisement).

KING, J. W., Dealer in all kinds of Jeweller's Materials Stones, Pastes, Locket Glasses, &c., 15, St. John's Square, Clerkenwell, E C.

JEWELLER'S SHOP FITTERS AND SHOW CASE MAKERS.

JEFFREYS, CHARLES, 103, Hatton Garden, E.C. Estimates free.

SAGE, FREDERICK, Steam Works, Commercial Buildings, 80 to 84, Gray's Inn Road, W.C. Large stock on view.

JEWELLERY CASE MAKERS.

EDWARDS, JOHN, 26, St. John Street Road, London, E.C

JEFFREYS, CHARLES, Jewellery Case, and Velvet Stand Manufacturer. The largest stock in England. 103, Hatton Garden. E.C.

SAGE, FREDERICK, Steam Works, Commercial Buildings, 80 to 84, Gray's Inn Road, W.C. Large stock on view.

MANUFACTURING WHOLESALE JEWELLERS.

JOSEPH, B. H. & Co., 20, Frederick Street, Birmingham, Manufacturers of the Registered "Standard" Sizes for jewellers.

HUMPHREYS (JOHN A.), 23, Wilderness Row, Clerkenwell, E.C., Jewellery, Chains, Wedding Rings and Keepers, &c.

LAWSON (P.) & GODDARD (C. GILBERT), Manufacturing Goldsmiths, Wholesale Jewellers, Clock and Bronze Importers, Dealers in Precious Stones, and also English, American, and Geneva Watches, 5, Hatton Garden. London, E.C.

BASNETT, S., 29, Augusta Street, Birmingham, Manufacturer of Coloured Gold, Jewellery, Sets, Brooches, Earrings, Pendants, Bracelets, Pins, Crosses, Slides, &c.

MYERS, N. A., 2, St. Patrick Square, Edinburgh, Importer of French, American, and German Clocks, Watches, Materials, &c.

MUSICAL BOXES.

GREENWOOD (JOHN) & SONS, Importers and Manufacturers of Clocks and Watches. Wholesale and for Exportation. Farringdon Road, near Clerkenwell Green, London, E C.

ADANK, J. JAQUES & Co., Manufacturers of Musical Boxes. Prize medal at Philadelphia. St. Croix, Switzerland.

OPTICIANS.

COHEN (JACOB) & CO., 36 and 37, Ely Place, E.C.; and Charterhouse Street, E.C., London; and 10, Rue Biranger, Paris.

SILVER CHAIN MANUFACTURER.

PHILLIPS HENRY, Manufacturer of Silver Guard and Albert Chains, Seal Keys, Bracelets, Necklets, &c., 24, Great Hampton Street, Birmingham.

SPECTACLE AND EYEGLASS MANUFACTURERS.

AWRENCE, N., 17, Holborn Hill, London, E.C.; Manufactory, Havelock Works, Walker Street, Shffield.

LAZARUS (S. J.) & CO., Manufacturers of Spectacles and Eye Glasses, and every description of Optical Goods 129, London Wall, E.C.

TURRET AND RAILWAY CLOCK MAKERS.

MILLAR, H. & R., Castle Bank Works, Edinburgh. Turret, Quarter, Chime, and Railway Clocks, 20 per cent cheaper than other makers. The only steam-power factory in Scotland. Photograghs. Established 1840.

WATCH DIAL PLATE MAKER.

WILLIS, THOMAS J., 10, Rydon Crescent, St. John Street Road, London, E.C.

WATCH BALANCE MAKER

COLLIS S. HASTINGS, 37, Whiskin Street, London, E.C

WATCH CAP MAKER.

BAKER, WILLIAM, 10, Meredith Street, Clerkenwell London, E.C.

WATCH CASE MAKERS.

DUNN, HENRY, 48, Rahere Street, Goswell Road, London, E.C.

NEWMAN, JAMES THOMAS, 42, Spencer Street, Goswell Road, London, E.C.

STRAM, ALFRED, 12, Ashby Street, London, E.C.

WATCH MANUFACTURERS.

HARGREAVES (I.) & CO., Wholesale Watch Manufacturers, 11, Slater Street, Liverpool.

HILL (THOMAS) & CO., 1, Hearsall Terrace, Coventry Watches for Home and Export Trade.

MICHAEL, MAURICE, Full Plate, Three-quarter Plates Centre Seconds, and Keyless Watches. For Home and Export. Norfolk Street, Coventry.

NEWSOME & YEOMANS, Wholesale Watch Manufacturers, Spon Street, Coventry. The performance of all our watches guaranteed for a number of years.

PENLINGTON & HUTTON, Chronometer and Watch Manufacturers, 2 and 3, St. George's Crescent, Liverpool.

SWINDEN & SONS, 27, 28 & 29, Temple Street, Birmingham.

WATCH AND CLOCK MATERIAL DEALERS.

BEDFORD, H. E., 12, Crown Street, Halifax.

COWEN, DAVID, 28, Withy Grove, Manchester.

MEREDITH (WILLIAM) & SON, 260, Goswell Road, London, E.C.

SAGGERSON, ROBERT, Wheel Cutter and Dealer in Watch Materials, Files, Tools, &c., Prescot, Lancashire.

SWINDEN & SONS, 27, 28 & 29, Temple Street, Birmingham.

THOMAS, WILLIAM, 7, Great Sutton Street, Clerkenwell, London, E.C.

THOMPSON (EDWARD JOHN) & VINE, 146, Goswell Road, London, E.C.

WEDDING RING MAKER.

ASTON, HENRY M., the original Wedding and Keeper Ring Manufacturer. An Extensive and varied stock always on hand. 12 Regent Place, Birmingham.

WORKING JEWELLERS.

CLEMENTS, HANDLEY & Co., 19, St. John's Square, Clerkenwell, E.C., all kinds of jewellery repaired on the shortest notice. Gilding, Plating, and Mounting for the Trade. (*See* advertisement).

JOHN ROBERT WILLIAMS & SON,
MANUFACTURING JEWELLERS AND GOLDSMITHS,
DEALERS IN DIAMONDS AND COLOURED STONES.
Warehouse: 108, Hatton Garden, E.C.
CHOICE BRILLIANT AND GEM RINGS. FINE SILVER-SET DIAMOND WORK. DIAMOND SUITES IN GOLD AND ENAMEL, ETC., ETC.
A Large and Choice Stock always on hand for selection.

THE WATCHMAKER JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall.—Registered for Transmission Abroad.

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TAXATION OF SILVER PLATE.

If we contrast the present position of the population of this country with what it was forty years ago, and note the changes which have been made in our laws with a view to our national prosperity, we shall be profoundly impressed with a sense of the great reforms which have been accomplished with reference to the taxation of commerce.

Forty years ago nearly everything was taxed which could be taxed. The very light of heaven was included in the long list of articles subject to the imposts of the exciseman.

Adam Smith had preached and preached in vain. The deaf adder had stopped it's ears. The deep reasonings of the philosopher had lain neglected, unread and uncared for, upon the dust-covered shelf. Political economy was regarded as a craze, and a man who asserted that "to tax labour was to diminish wealth," and that "taxation of trade was a fiscal mistake," was regarded as a dreamer who had no place in practical politics.

Sir Robert Peel became Prime Minister for the second time in 1841. Then, for the first time, the era of Free Trade dawned upon English politics. Protectionists found their pet theories treated as fallacies. The light of heaven streamed through the hitherto closed-up windows, not only of men's houses, but of men's minds, and with the advent of foreign corn came the enlightened policy which has swept away taxation from not less than twelve hundred different articles, with what result to the revenue it is needless to indicate.

The school-boy now understands that wealth is not to be reckoned by the amount of gold which can be retained in the country. It no longer requires the talent of a philosopher to prove that labour and capital, *i.e.* accumulated savings, are required to produce wealth from its only source, *viz.* land; that the wealth of the world is equal to the labour of the world; and therefore, that to tax labour is to place a hindrance upon wealth.

And yet we still hear the old familiar cry "We shall all be ruined!" whenever a tax is sought to be removed. The same cry which the farmers raised to Sir Robert Peel was heard again and again by Mr. Gladstone, as he applied the pruning knife of modern legislation. And now again we hear the cry "We shall all be ruined!" when it is sought to obtain the abolition of the tax upon silver plate, which, to use the words of a contemporary, is "almost ludicrous in its absurdity." That it is mischievous in its effect has been most clearly demonstrated in a paper read to the Social Science Congress by Mr. E. J. Watherston, a silversmith perfectly competent to form a correct opinion of the present position of his trade. He tells us that the tax is a war-tax, levied originally to pay for the Spanish war; repealed, as was then said, in 1758, "for the encouragement of the trade;" re-imposed, in 1784, to pay for the American war, and increased to pay for the French war; so that in 1815 it stood at eighteen pence an ounce, at which it has remained ever since, being at the rate of 20 per cent. upon such articles as spoons and forks, and 12½ per cent. upon articles of daily use.

The result, as might be expected by any student of the financial history of the country, has been to confine the trade within the narrowest possible limits, and positively to decrease it in twenty-three years by nearly 200,000 ounces, representing a wholesale trade of about £100,000 a year! Can anything be more deplorable? Although the wealth of the country has increased, and although the number of buyers of articles of luxury has been multiplied a hundred fold, here is a trade decreasing year by year. No wonder, when it is remembered that the cost of production is in many instances doubled by means of taxation. A tea-pot, we will say, costs thirty shillings to produce; it weighs twenty ounces, thirty shillings must be paid for duty, making cost of production three pounds. It may well be asked, What trade could stand such an unjust tax? But this trade has not only to stand the tax, but it has to compete with the electro-plate trade, which is wholly untaxed, and which is permitted to assume marks closely resembling the Hall mark upon the genuine article. Surely the time has come when this anomalous state of things should cease to exist!

But possibly the best arguments for the abolition of the tax upon silver plate are to be found in the interests of Art progress and of technical education. As Mr. Watherston says—

> A visit to South Kensington would at once illustrate the truth of the proposition. Here we find scores of students whose object it is to work into the several branches of trade. A glance at the Schools will suffice to show the great preference given by the students to those trades which are hampered by no restrictions, such as carpets, furniture, decoration, curtains, paper-hangings, brasswork, fenders, mechanical engineering—anything, indeed, but to the silver trade! And why? Because the silver trade, being taxed, and consequently confined within the narrowest possible limits (the whole trade of the United Kingdom not amounting to more than £400,000 a year), offers no temptation to artists to adopt it as a profession. It is not the nature of a declining trade to attract labour or capital to it; whereas the trades above named not only attract labour and capital to themselves, but offer the very highest rewards to artists of eminence for their successful development.

Again—

> With reference to technical education, it is manifest that no scheme, however wisely devised, can benefit the silver trade until the tax is abolished.
>
> In the first place, for so unremunerative a trade, no one will care to be technically educated.
>
> Secondly, inasmuch as every scheme must include theory and practice, it is plain that so long as the tax exists, there must be a serious hindrance to the work of education. So long as a law remains in force that, before an article is put together, almost in its rough state, it must be sent to Hall and a duty of from 12½ to 20°/o be paid upon it, it is useless to talk about technical education for the silversmith. The difficulties are, in point of fact, insurmountable."

It is perhaps unreasonable to suppose that, just at the present moment, the Chancellor will listen to any proposal for the abolition of taxation; but so many are the advantages to be derived from the abolition of this paltry tax, yielding probably not more than £50,000 a year, we may well be permitted to hope that its continuance may be rather one of months than of years.

The Steam Clock Factory of Messrs. Gillet and Bland at Croydon.—The *Croydon Guardian* says the fame of Messrs. Gillet and Bland as manufacturers of church and other clocks for large buildings, also as church bell founders, naturally excited the curiosity of many visitors to Croydon during the Church Congress week, and the firm, with much consideration, freely opened their factory to the inspection of all so interested. A considerable number of visitors availed themselves of the privilege, and were conducted through the works by a member of the firm, who courteously explained the various processes so as to be readily understood.

PRACTICAL INFORMATION FOR THE TRADE.

A very good preventive against rust on steel articles is to coat the surface with a solution of gutta-percha made by dissolving gutta-percha in any of it solvents—benzine, for instance. This is the plan used for varnishing steel pens, and has been proposed for balance springs, although we have not yet heard of any of the results of its application for that purpose.

Our German contemporary, in answer to a correspondent, says:—A good coloured foil for setting stones can be prepared by taking *bright* tin foil and coating the surface with a varnish of shellac in alcohol, tinted to the depth of colour required by any of the aniline colours that are soluble in alcohol. Apply the varnish with a broad flat brush: it will quickly dry. Flatten nicely by passing it between rolls, or by burnishing. The proper material, however, is copper foil, silver plated, and coloured as above.

Cement to Fasten Rubber to Wood or Metal.—Make a cement by soaking pulverised shellac in ten times its weight of strong ammonia: this gives a stringy mass, which in three or four days will become liquid without the aid of hot water. This cement softens the rubber, which, after the volatilisation of the ammonia, becomes hard and impenetrable to gas or liquids. —*Revue Chronométrique.*

Directions for Melting.—Mons. Guetlier gives the following directions for melting, in his valuable work on Metallic Alloys: Heat the crucible to a red and sometimes a white heat, and melt in it the least fusible component of the alloy. After fusion, increase the heat somewhat, so that it will bear the addition of the next fusible one without too much reduction of temperature Introduce the metals into the pot in the strict order of their fusibility, each being fully melted before the next is added. When some of the components are fusible and some refractory, the alloy should be covered with charcoal, or if rich in tin it must be covered with a layer of sand. Stir thoroughly before casting, and, if possible, while pouring, with a white wood stick. Always add a small portion of old alloy to the new, if at hand, and in all cases use clean crucibles.

Mons. Guetlier, whom we have already quoted, recommends the following solders:—

Hard solder for Gold.—

Gold 18k. $\frac{750}{1000}$ fine	18.
Silver	10.
Pure Copper ...	10.

Hard solder for Silver.—

Silver	66.
Copper	23.
Zinc	16.

German Silver solder.—

German Silver ...	5.
Zinc	4.

Solder for Platinum.—

Pure gold with ½ per cent. of alloy of platinum and irridium.

Hard solder for Aluminum Bronze.—

Gold	88 88.
Silver	4 68.
Copper... ...	6 44.

Medalling hard solder for Aluminum Bronze.—

Gold	54 04.
Silver... ...	27.
Copper ...	18 06.

Solder for Iron and Brass.—

Tin	3.
Copper ...	39½.
Zinc	7½.

This solder is said to have the same expansibility as brass.

SAFES AND LOCKS—PAST AND PRESENT.

In ancient times the chief riches, independent of real estate, consisted in the accumulation of the precious metals or of jewels, while at the present time these are the smallest part of our personal property, which consists of paper representatives of value, stocks, bonds, and notes of all kinds. In consequence, formerly the transportation or storage of a large amount of wealth was difficult and laborious, whereas now a man can carry in his pocket evidences of values which formerly required waggons to move. In Egypt, at the earliest period of history, the organisation of government had attained a point of perfection which made its treasury an important interest. The stores of money gathered from the heavy taxes laid upon industry of the country were carefully guarded in securely-built treasure houses, fastened with locks of elaborate construction. Wilkinson, in his "Manners and Customs of the Ancient Egyptians," describes a key made of iron which he found in the ruins of Thebes, and which had a shank 5 in. long, the handle being made by a loop at one end, while the other was turned at a right-angle, to form the operative part of the key, which was furnished with three teeth, or points, to fit in corresponding cavities in the lock. Other keys have also been found and described, from which it appears that the Egyptians were at this very early period acquainted with some of the principles which have been supposed to be distinctive of modern improvements in locks; for example, tumblers, which hold the bolt fast until they are first moved by the key. In fact, rudely constructed locks upon this principle were also in use by many of the nations in Europe during the Middle Ages, although it has only recently been made use of by our modern lock-makers. The discoveries in Herculaneum and Pompeii have shown that, among the Romans, locks of intricate workmanship were in ordinary use, and in Great Britain keys have been found that date back to the Roman occupation of this country. Among the Chinese, lock-making, has for a long time been well understood, and locks constructed upon the principle of the famous Bramah lock, which was invented in 1784, have been there made of wood from early times. In these the tumblers are made of different lengths, intended to fit exactly the sizes of the wards in the key. During the Middle Ages chests for the safe keeping of valuables were ordinary articles of furniture in houses, and were made very elaborately, strengthened with iron work of various kinds, and furnished with locks which were frequently decorated in very artistic ways. These chests, which were really the safes of that time, were protected from being broken open by bands of iron. The burglar's cunning had not at that time reached the perfection it now has, and a modern "cracksman" would laugh at the provisions then made for security. Nor had the burglars of that time the education in their art which those of the present time have, so that doubtless the security was nearly satisfactory. The modern spirit of enterprise had not yet arisen to inaugurate the struggle for the mastery between the "cracksman" and the safe-inventor, and the contest was carried on upon a different plan. The wealth then depended more upon the impregnable character of the house than upon the strength of the chests within them. With the advent, however, of the joint stock system, the introduction of paper-money, and the commencement of our modern commercial activity, wealth began to assume a more portable form, and large values are now contained in conveniently small packages. In Sir Walter Scott's "Rob Roy" an admirable instance is given of the simplicity of methods used in rough and violent conditions of society at that time, for the protection of valuables. Rob Roy showed a leathern bag studded with large headed nails, which he had made for the protection of his treasure. The mouth of it was secured with a lock, and he was very proud of a contrivance introduced into it, by which a small concealed pistol would be discharged at any one who should tamper with it. It had never occurred to him that the bag itself could be easily cut to pieces with a sharp knife, without in any way approaching the lock so as to discharge the pistol. The incident, which is said to have been founded upon fact, shows how little accurate study had been given to their speciality by either the defenders or the burglars of valuables. The oaken box defended by iron bars, which did duty for our present burglar-proof safes during the last century, began in the early part of this to be replaced by boxes covered entirely with iron.

About the year 1820 attention was turned towards making fire-proof chests for valuables. With the introduction of paper representatives of wealth, their destruction by fire became possible. A considerable amount in any of the precious metals if exposed to a conflagration, even though it were melted, could be recovered without great loss from the ruins, but there was no such opportunity for paper. The first attempts to make fire-proof safes appear to have been made in France. The safes were made with double walls, the space between them being filled with a non-conducting substance—a composition. The idea was quickly taken up in the United States, and in 1843 the first patent was issued to Daniel Fitzgerald for making fire-proof safes. This was afterwards assigned to B. J. Wilder, and the safes made thereunder are known as the "Wilder Patent." In these the space between the walls of the safe was left vacant, dependence being had on the non-conducting properties for heat of the air thus enclosed to preserve the contents of the safe thus made. Other substances, which had also a high non-conducting power of heat, were proposed for the filling of the space left between the walls, and numerous patents were granted for various compounds, both in this country and in America.

The attention of inventors was the more directed towards this subject by the occurrence of extensive conflagrations, especially that of New York in 1835. Asbestos, mixed with plaster of Paris, clay, alum, fire-clay, mica, and chalk, have each in turn been used with more or less effect, and in turn proclaimed as absolutely fire-proof. The intense heat, however, to which safes are subjected in many of the conflagrations raising them frequently to a bright red heat, and sometimes to a white heat, has shown that none of these fillings were, as they claimed to be, absolutely fire-proof. The protection against burglars is, however, now the most important point in the building of safes. While the inventors of locks and safes have been engaged in devising new and ingenious methods of construction to attain this end, the burglars, on their part, have been equally laborious and shrewd in studying new methods for overcoming the obstacles offered to the prosecution of their profession. The appliances of a first-class burglar are not complete at the present day unless he has an assortment of drills of all degrees of hardness, blowpipes for taking the temper out of the steel plates, a supply of powder, nitro-glycerine, and fuses, wedges, files, and saws, together with a mirror for examining the interior of the locks, skeleton keys, and, above all, a thorough experience as a practical mechanic, together with a full comprehension of the details and the theory of lock-making.—*Furniture Gazette.*

To Fasten a Joint on a Watchcase.—First remove the old joint and all of the solder with a joint file and graver, then select or make a piece of joint wire the proper size, and fit and clean; place the case on a piece of coal, lay on the wire and fasten together; apply borax, and just enough silver or gold solder, as the case may be, to solder it; then boil out in pickle, and clean and fit the parts together.

Recipe for cleaning Silver Plate, Show Cases, etc.—Fill a bottle two-thirds full of aqua ammonia; add to it common whiting sufficient to make a thin paste. If fine silver ware is to be cleaned, it is better to add prepared chalk instead of common whiting, which often contains impurities that scratch a fine surface. Apply it with a sponge or soft rag. When dry, polish off with chamois skin or a soft cloth.

HOROLOGY.

(Continued from page 73.)

XXIX.—Its Relations to Astronomy.

By G. B. Miller.

THE law of orbital motion, and the paths described by satellites around their primaries, are subservient to this attraction of gravitation; for from its consideration Newton found that a body projected into space will move in a conic section when attracted by a fixed body, the force of attraction being inversely as the squares of the distances. Comets are a forcible example, and Kepler proved by observation that the planets move in ellipses. The sun, in our system, being the greatest mass, attracts all the several planets inversely as the squares of the distance and in proportion to the mass, the enormous diameter (886,877 miles) of the sun rendering its mass greater than the combined matter of all the bodies revolving around it. The stability of the whole solar system is thus secured, as will be seen when the ellipticity of the various orbits is treated on. Kepler laid down, or rather discovered, another law, which was that the squares of the periodic times of the planets are proportional to the cubes of their mean distances from the sun's centre; and from the law of the squares of the distances it will be seen that all the planets, whatever their mass, would, if at equal distances from the sun, fall to its surface in equal times. This law applies not only to the planets and comets in their relation to the sun, but to the system of the planetary satellites as each is held to its primary by the attraction of gravitation.

Not only does this affect the planets and comets of our system by the mutual disturbance of the different orbits, but the effect of the action and reaction of the attraction of gravitation extends far beyond our solar limits. From certain data, it is established that the sun itself, with its whole train of satellites, is subject to the same law, and is revolving in space around some centre (not yet defined) located in the vast expanse outside our own atmosphere. The power of analysis as applied to the laws of gravitation can hardly be better illustrated than by citing the case of the new planet discovered by Le Verrier, which was a beautiful illustration of induction from recognised facts. The only known external planet (the sun being the centre) of our system was Uranus; its seven elements had been determined and its orbit supposed to be ascertained. Now it must be understood that the real place, or, in other words, the latitude and longitude of a planet or star cannot be determined by observation, as the periods of translation in space are too great; but we may find its distance from the sun. We have stated that by Newton's law all bodies revolving around a fixed point of attraction must describe a line of some conic section. Such being the case, all the planets have orbits more or less elliptical, and the sun must be situated in one of the foci of the ellipse, which would of course produce an excentricity of the orbit. We must first determine the major axis; next, the position the sun takes in relation to the orbit described by the rotating planet, and these two elements give us the form of the orbit. The perihelion as to its longitude must be found—that is, the longitude of the point of the least distance from the sun—the inclination of the orbit to the plane of the ecliptic, and the longitude of the ascending node, by any of which we may determine the position of the planet in space. The period of its revolution around the sun, measured by our division of time, assuming our year as the unit, and the epoch of the node must be determined in order to find the true place of the planet in its orbit at any given instant. These are called the seven elements of the orbit.

In the case of Uranus all these seven elements of the orbit were well known, but the path described by the planetary body did not coincide with the recorded observations. There were some disturbing forces at work which varied the line of motion. Adams in England, and Le Verrier in France, set about finding the disturbing causes. These two astronomers, without a suspicion of the work of each other, determined that outside the orbit of the planet Uranus there must be a body revolving around the sun; as the laws of gravitation were supposed to be as potent in space as on the earth's surface, by analysis the still unknown body was weighed, and, what is still more wonderful, its position at a particular minute was determined.

Le Verrier, who first published to the astronomical world the particulars of the sister planet, sent his calculations to the observatory at Dresden, as there a very accurate catalogue of the stars had been made. His calculations were verified, for on the telescope being directed to that point of which the latitude and longitude in celestial space had been indicated by Le Verrier, the planet was found. In astronomy the discovery was an event never before equalled, but it had long been anticipated, as the following quotation from Mrs. Somerville will show. Writing in 1840, she says: "The tables of Jupiter and Saturn agreed most perfectly with modern observation; those of Uranus, however, are already defective, probably because the discovery of that planet in 1781 is too recent to admit of much precision in the determination of its motions, or that possibly it may be subject to disturbances from some unseen planet revolving around the sun beyond the boundaries of our present system. If, after a lapse of years, the tables formed from a combination of numerous observations should still be inadequate to represent the motions of Uranus, the discrepancies may reveal not alone the existence, but even the mass and orbit of a body placed for ever beyond the sphere of vision."

Except the invisibility, the prediction has been verified, and still more our admiration is exercised in contemplating the entire subject of astronomy and the high power of mathematical reasoning displayed by its devotees, in the fact that from the perturbations of the new planet it has been found that another body, still more remote from the sun, belongs to our system. This mutual attraction of the heavenly bodies becomes a very complicated problem to solve, when we take them all into consideration; but as they are so remote, and the disturbances so minute compared with the earth's mass and motion, they are scarcely of sufficient value to become the subject of such a tedious and complicated mathematical analysis; nevertheless, there is a very celebrated problem, denoted the problem of the three bodies, which enables the astronomer to ascertain the motions of translation of the planets. The sun, earth, and moon were the original bodies chosen for the elucidation of the proposition. Suppose the mass of each to be known, the velocities of the original projection into space from three given points, as well as the direction given, the conditions of the law of gravitation being that the force of attraction is directly as the masses, and inversely as the squares of the distances, it is required to find by analysis the lines that would be described by these bodies and the point in those lines at any given period. The solution of the question was a triumph for astronomy, and it also was a boon to horology, for on it depended a correct knowledge of the motions of the objects used in taking observations for time.

Before proceeding to a further consideration of the perturbations caused by the mutual attraction of the planets, we must state their relative positions one to the other, and also to the sun. No two planets move in the same plane around the sun. Taking the earth's orbit, or plane of revolution, we find Mercury, Venus, Mars, etc., having planes of revolution more or less inclined to our elliptic. It follows, then, that at times any one planet may be above or below the plane of the earth's orbit—the sun being considered a fixed point of attraction. This position of the two planets induces a considerable change, not only in the plane of the orbit at times, but in the form, thus at certain junctures increasing the ellipticity, at others again reducing it. It must be remembered, however great the change, the major axis remains the same, so that if the orbit is increased in rotundity, the earth would have to move through a greater distance in space than with a greater ellipticity, and the rate of the motion would differ materially in different parts of the orbit. Thus the inclination of the plane of revolution of the different planets to that of the earth has a sensible effect on the year, for by observation and analysis it has been found that the orbit of the earth is decreasing in excentricity by 40 miles a year. There is another disturbance, and that is of the inclination. We can obtain a good illustration of the inclination, its disturbing forces, and the latitude of the planets, if we take two circles or hoops of different dimensions, and piercing them edgewise in a line that passes through the centre of each, place them on a wire as a common centre, being careful to keep them concentric—we have a very fair mechanical view of two orbits (we may neglect both the excentricity and ellipticity). Now if we place the apparatus on a level surface, say a table, we find the two planes of these models coincide, and the wire centre is the line of the nodes; but if we lift one side of the outer ring and place a rest under it, we destroy the coincidence of all the parts except the two points on the nodal line. We may vary the inclination as much as we choose, and thus show in succession the relation of the earth's orbit to the positions of the rest of the planets in a very explicit manner. It will be obvious that if the periods of any two planets vary, their relative positions must likewise vary; so if the two bodies have started at one of the nodes at a given instant of time, the one whose periodic time is the least will have made an annual revolution and returned to the starting point, while the other will have moved in its orbit a space proportionate to the periods. Thus if one body, E, has a period of unity, and the other, I, one four times as great, E would have arrived at the starting point while I has passed over only one quarter of its orbit, and consequently is at the highest or lowest point of its orbit, while E is at the node; resuming the motion, E will in one quarter of its revolution arrive at the same highest or lowest point of its orbit; but during this time, I has moved one fourth of the distance, so that it is one sixteenth of E's period in advance. Continuing the reasoning, it will follow that there will be a common point in the two orbits where E is above or below I. By the law of gravitation the attraction of the largest mass would tend to lift or depress the smallest from its path; this really occurs.

Taking our simple apparatus, we can get an idea of the latitude of a body. We will suppose E and I again placed in their respective orbits at the same node, and set in motion at the same ratio of periods; as E goes in advance of I, the planes of the orbits begin to separate, and the perpendicular distance of I above the plane E is the north latitude of I; if below, it is south. The celestial latitude of any body is, then, the angular distance of the body from the ecliptic.

The most interesting aspect of the law of gravitation is afforded in the consideration of the stability of our whole system of sun and planets, with their satellites. The subject has been discussed by men whose names are household words in the astronomical world. La Grange first demonstrated the fact, and the proposition and its successful solution won for him the following compliment from Professor Playfair: "A discovery that must render his name for ever memorable in science and revered by those who delight in the contemplation of whatever is excellent and sublime." La Place and Poinsett extended the demonstration to more accurate results.

La Place laid down the proposition that there is a great invariable plane passing through the centre of gravity of our entire system, about which the whole oscillates within very narrow limits; and that this plane will always remain parallel to itself, whatever changes time may induce in the orbits of the planets in the plane of the ecliptic, or even in the law of gravitation, provided only our system remains unconnected with any other. La Place found this plane to be inclined to the ecliptic at an angle of 1° 34′ 15″ passing nearly midway between the orbits of Jupiter and Saturn and through the centre of the sun; the sum of all the inclinations being thus divided by this great plane, which may be considered the equator of the solar system. Now as this plane is invariable, it will in time enable astronomers to determine whether our system is connected with any other. It is highly probable that the sun, with its attendant satellites, is revolving in an immense orbit around some distant unseen primary, and if so the variation of this great plane after the lapse of ages will give the then living astronomer a clue to the size of the orbit and the distance of the primary.

Even imagination is utterly incompetent to take in distances so vast, or masses so great, as would pertain to such a system, of which our sun with its train of attendants is but a planet.

(*To be Continued.*)

Civic Jewellery.—The official chain and badge of Mr. Alderman and Sheriff Staples is Elizabethan in style, and contains on a handsome framework the Arms of the City, the County of Middlesex, the Leathersellers' Company, and the Sheriffs'. The chain is of 18 carat gold, and is unusually massive; it is formed of a succession of solid knots, in three long rows, festooned from the badge, to a large monograms circle at the back. Both badge and chain were designed and made by Messrs. Harvey and Gore, 126, Regent Street, to whom great praise is due both for the design and execution. The chain is one of the most costly ever worn by a Sheriff.—*City Press.*

New Process of Electro-Plating.—Professor A. W. Wright, of Yale College, New Haven, Conn., has discovered a new and brilliant method of electro-plating, which promises to be of great utility. Taking advantage of the fact that the various metals may be volatilised by the electrical current, he provides a hollow vessel from which the air is partially exhausted. Within this vessel he arranges opposite to each other the two poles of an induction coil. The article to be electro-plated, a bit of glass for example, is suspended between the poles. To the negative pole is attached a small piece of the metal that is to be deposited on the glass. From three to six pint grove cells are employed, yielding, by means of the induction coil, an electrical spark from two to three inches in length. Under the influence of this spark a portion of the metal of the electrode is converted into gas or volatilised, and condenses upon the cooler surface of the suspended glass, forming a most brilliant and uniform deposit. The thickness of the plating thus produced may be regulated at will, by simply continuing the action of the electricity for a longer or shorter period. That the metal is actually volatilised is proved by examination with the spectroscope during the process of the operation, the characteristic lines of whatever metal is used for the electrode been fully revealed. This may be classed as the discovery of a new art, and is certainly very interesting and remarkable. In brief, it consists in plating the surfaces of substances with metals, by exposing such surfaces to the hot vapours of whatever metal it is desired to plate with. Professor Wright has already made a number of valuable practical applications of his discovery. He produces mirrors with silver, platinum, iron, and other metal of the most pure and resplendent character. He deposits gold in a layer so thin that it is only 0·000183 mm. in thickness, or approximately only one fourth the wave length of a red ray of light. He obtains curious colours in the metals varying with the thickness of the deposits, and opens up a new field for investigation into the nature of metals and other volatilisable substances, and perhaps of light. He shows that his electrically deposited metals have improved qualities; that telescopic and heliostatic mirrors for example, of platinum deposited on silver, by his process, will be unalterable, and the promise is that we shall before long be able by this new art to produce telescopes and other scientific instruments of greatly improved character.—*Scientific American.*

DIAMOND CUTTING IN CLERKENWELL.

PROBABLY many of our readers have never had an opportunity of inspecting a diamond-cutting establishment, for which reason a few particulars concerning this interesting handicraft will not be out of place. And having recently visited the well-known lapidary works of Messrs. W. Ford and Co., situated on Clerkenwell Green, we are indebted to the courtesy and attention of the principals of that firm for the information there obtained.

On commencing our round of inspection we found the factory divided into several departments, each devoted to some special purpose. We may divide the process of diamond cutting into three branches—viz., *Cleaving or Splitting*, *Cutting*, and, finally, *Polishing*. These do not, however, comprise all that calls forth the exercise of skill in the diamond-cutter. He must know, before proceeding to operate on the stone, the exact nature of its internal structure. The stone may be laminated, or have small fissures, which, after much labour has been bestowed, render the gem liable to crack, or at least very materially injure its value.

Although so very hard, almost the first tool generally used is made of steel, advantage being taken of the fact that most diamonds have lines of cleavage. All crystallised bodies are formed so that a line of cleavage may nearly always be found; that is, there is always some direction in which the crystal will split easier than in any other. This line of cleavage is determined very much by the form of the crystal, though each substance has its own peculiar manner and direction of cleavage. Octahedronal stones are the best suited for this purpose, which is generally achieved with success. It is evident that where the risk of spoiling a fine stone of great value is so imminent, the workman very carefully examines the object to be subjected to this process. For cleaving with the steel tool, the stone is imbedded in the ordinary lapidary's cement. The part to which the tool is to be applied is cleaned of its coating, and a scratch made across its face with another diamond having a sharp, cutting edge. The tool is then applied to the groove thus made, and the stone clipped off with a sharp blow. This, of course, leaves a plain surface, and in order to get the ultimate form, the above operation has to be repeated to get each plane in succession. This cleaving process is very delicate work. The diamond, when a blow is struck, or an edged tool placed parallel to one of the octahedral faces of the crystal, readily splits in that direction; but to recognize the precise direction on the complex and generally rounded form of the diamond crystal; to cut a little notch by means of a knife edge of diamonds formed of one of the slices cleaved from a crystal, and to cut that notch exactly in the right spot; then to plant the steel knife that is to split the diamond precisely in the right position; finally, with a smart blow, to effect the cleavage so as to separate neither too large nor too small a portion of the stone—these various steps in the process need great skill and judgment, and present to the observer the interesting spectacle which a handicraft dependent on experience of hand and eye always affords.

The object of the cutter is to get a regular form, to take off as little as possible, and make the form so that the action of light shall have its greatest effect. There are many considerations that must determine the workman's decision as to the form he intends to give. A small flaw near the surface must be removed, or the value of the gem would be lessened; its high refractive power shows the slightest blemish when finished.

The high refrangibility prevents the operator always correctly deciding whether or not the flaw is in the interior or on the surface, and a person with a correct and well-practised eye may often purchase to great advantage stones which appear to be flawed quite through, but are in fact only superficially blemished. The workman has also to take into view the desirability of cutting the stone so as to get the greatest breadth, or *spread*, as it is technically called, after he has taken off all the flaws. In the choice of cut, he must be guided somewhat by fashion's demands, for the ordinary tastes of the public must determine the ultimate value of the gem; and therefore the best artisans in the diamond cutting trade decide the form, number of facets, and so forth, by the eye, rather than by the old mathematical rule. Another essential task is to ascertain the hard points, as the facets have to be selected accordingly. The hard points are the angles on the original octahedron, and it is necessary to cut directly across these, or the force required to polish may tear up the thin laminæ that face the soft side. This fact accounts for the great difficulty that has been encountered in the application of steam to this very tedious process; and yet it would appear that with a good *lap* the artisan might hold his diamond with as much precision as by the old hand process.

In the establishment above mentioned, with few exceptions, diamonds are cut into one of two forms—the brilliant and the rose. The double-cut brilliant has sixty-four facets, besides the table and collet. The single-cut brilliant, with the same general form, has only eight facets above and eight below, besides the table and collet. The rose is also double or single cut, according to size. (At the time of our visit a beautiful pale yellow Cape diamond was in progress of being formed to the shape of a double-cut brilliant. It weighed 105 carats in its rough state, and cost £2,000; when finished its weight will, however, be reduced to about 65 carats.)

The next step is to bring the facets up to a true level. To effect this, the stone is cemented to a stick, and another stone is similarly treated, with the two pieces over a box with a bottom to catch any dust that may come from the abrasion. The only difference in the setting is that the cutting tool has its solid angle; that is, its hardest part operating directly on the face of the cleaved diamond. It will readily be seen that the abrasion must be a work of patience as well as of skill, in order to get just the proper plane for each facet. As each has been thus laboriously made, the stone is successively changed to present other parts to the action of the cutting diamond, and each having been operated on, the stone is then ready for the polishing of the facets. Its appearance at this stage of progress presents, under a magnifying glass, ragged, rough edges, and a broken, foliated surface, with a glistening lustre on those facets which are nearly in the direction of the *natural laminæ*, and on the other facets a more even surface, but of dull, opaque, greyish white colour. The workman is also compelled to observe at intervals what effect the style of cutting it producing.

The diamond having been brought up to the condition thus described, we will proceed to give an idea of the polishing, which is, in itself, exceedingly interesting. The polishing mill, which is of cast iron about a foot in diameter, revolves horizontally, and is, as may readily be conceived, placed on an upright arbor and the power so applied as to give a high speed (of about 2,000 revolutions per minute) to the lap.

If the stone, during this grinding or polishing, should change its position, it is evident that no flat or plane surface could be produced. The more ordinary gems, even the sapphire, may be held by the ordinary cement used by the lapidaries; but in the case of the diamond some better hold must be had of the stone to ensure parallelism. To effect this, the workman uses what is technically called a *dopp*, which is nothing more than a brass cup of such diameter and depth as may be necessary. This has a stem of four or five inches in length, and in order to prepare the dopp it is turned inside and then filled with ordinary soft solder, which is projected above the edges of the cup, in a conical form. The apex of the cone thus formed may be easily softened by heat, and the diamond enclosed, or, rather, set in a way that any facet on which it is proposed to operate may be exposed. The diamond having been set satisfactorily in the soft solder, the stem is grasped in an iron clasp that, resting on two edges at the other end, is kept in its radial position by means of iron pegs. It will be seen that this arrangement gives a freedom of motion to the holding arm which could hardly be attained otherwise. When the stone in the dopp is ready, the whole apparatus is applied to the bench with the stone resting on the lap. The holder is weighted down to give the required amount of pressure, which must be graduated, so that the heat caused by the friction may not melt the solder, and thus unset the stone. Such an event would be serious trouble, involving not only the chance of flawing or breaking the stone; but the diamond being so hard, it tears up the face of the lap. The lap is from time to time supplied with diamond powder and oil as, in the judgment of the operator, the work requires. The polishing process is very slow, a single facet sometimes requiring four or five hours; this is somewhat compensated by the practise of placing three or four diamonds on the same lap, attended by one workman. We need hardly mention that in every stage of the proceedings the utmost care is taken to preserve any dust or pieces that may be abraded. Messrs. Ford and Co. have forty of these mills arranged in two rows on the ground floor, each row extending the entire length of the building, with sufficient room between the mill and wall for the man to work comfortably. Belts leading from a driving shaft in the middle give motion to the mills. There are, however, some eight more on the second floor, at which the same number of apprentices are at work, and who are under the personal training of Mr. W. Ford.

About a century and a half back, London was the chief seat of the diamond cutting business. Circumstances which we need not revive here caused this industry to be removed to Amsterdam, which city till very lately held the monopoly of this trade. To the untiring efforts of Mr. W. Ford we are indebted for the revival of this industry in England, and it is with great satisfaction that we see his labours crowned with success.

About seven or eight years ago Mr. Ford, then a lapidary in Red Lion Street, first turned his attention to the cutting and polishing of diamonds. Great perseverance was necessary, because people naturally hesitated to entrust valuable crystals to the least chance of unskilled handling. This prejudice was, however, gradually overcome, as Mr. Ford's skill was well able to show that the diamond cutters' art was not in the sole possession of the Dutch. Although at first mostly dependent on Dutch workmen, they are now all superseded by Englishmen, to the great satisfaction of the firm. It is to be regretted that some of the English diamond cutters emulate the jealousy of their Dutch brethren, and try to keep their experiences to themselves. Such is, however, the case; so that Mr. Ford was obliged to separate men and apprentices, and to take the latter under his own supervision. We must say that they are likely to do justice to their teacher, judging from the excellent work we have seen from their hands. Already, in 1874 some of Mr. Ford's employés carried off several prizes offered by the Turners' Company for lapidaries' work. Mr. Vincent Albertoldi secured first prize for his remarkably fine shell and cross of carbuncle, and Mr. Henry Giles Spencer the second, for carved onyx shell, bow and flower of great beauty. Their exhibits were bought by Mr. Hunt and Professor Tennant, two of the judges for the lapidary work—a mark gratifying alike to the artists and their employer. In Class D (diamonds) Mr. John Parsons and Mr. Alex. Watts, also employed in this factory, took second and third prizes respectively. In 1876 Mr. Charles Errington, Mr. George Brown, and Mr. Thomas Jones were again successful competititors for prizes offered by the same company—all employés of this establishment.

A few days since the establishment was visited by several distinguished persons, among others were the Baroness Burdett-Coutts and Professor Tennant, both of whom evinced great interest in every department.

Having derived great pleasure from everything we saw in the various departments of the establishment, we cannot withhold our thanks to the members of the firm, and especially to Mr. W. Ford, for the attention received, and the gratification which the visit afforded us.

The well-known firm of Messrs. T. and J. Bragg, of Birmingham, have recently executed for Mr. J. Blackhurst of Crewe (to whom the order was given), a chain and badge of office for the Mayor of the last-mentioned town. The chain is massive, of 18-carat gold quality, Elizabethan in style, alternate links being composed of a monogram, "C.C.," the initials of the Corporation. Between these are larger links, each bearing a shield to contain the name and year of office of a Mayor in succession, each shield being surmounted by a civic crown. The centre link is larger, with shield bearing the monogram of the first Mayor, Mr. J. Atkinson, and is supported by two civic maces. The badge, which is suspended below the centre link, and can be worn with or without the chain at pleasure, is an important work, complete in itself, bearing the device, crest, and motto of the borough. The shield is as free from heraldic conventionality as any modern town can desire; and the Corporation has done well to give up the Latin form of motto, and to adopt the simple and direct English, "Never behind." This sentence is in gold letters, upon an enamelled riband, beneath the shield. The shield is intended to convey the idea of progress. The four quarterings represent as many various stages in the arts of locomotion, from the pillion, the pack-saddle, the stage-coach, and the canal boat, all culminating in the last new locomotive engine and tender brought out at the great engine works of the London and North-Western Railway Company at Crewe, a small model of which forms the crest in the design, the walled crown indicating a borough, and the national emblems of oak and laurel complete a work which is at once harmonious and picturesque. The whole is designed by Mr. J. W. Tonks, and reflects great credit on all concerned.

Repairs to the Westminster Clock Tower.—The re-gilding and painting of the Clock Tower of the Houses of Parliament was completed on Saturday, the 13th ult., and the whole of the scaffolding surrounding the structure has been removed. The wires connecting the great clock at Westminster to the Royal Observatory at Greenwich are also completed. The following is the official report just issued: "Since Friday last the great clock of Westminster, by means of telegraphic apparatus, added by Messrs. Dent, reports its own time to the makers twice a day, the signal passing on from the Strand to the Royal Observatory at Greenwich. At the commencement of this year the works were found to be getting very dirty, but its variation scarcely ever reached three seconds. The principal work besides cleaning was an entirely new escape-wheel, as the old one had of late been getting very shaky. Two months previous to cleaning the clock, Messrs. Dent had to remove the escape-wheel to their factory for repair. On that occasion, they sent up to the Clock Tower a sufficient staff of workmen, with chronometers, and, at a good deal of pains, kept the clock going with the same accuracy as if it had been controlled by its pendulum. The new escapement is so constructed that it is impossible for its several parts to get loose.

The Nutmeg Lever Clock, recently introduced by the Seth Thomas Clock Co., is in such favour that it is a matter of surprise how the supply keeps pace with the demand. We learn from the *New York Jewellery Circular* that over 100,000 have been sold since its introduction.

Prices Current for Gold and Silver—Value Given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 8d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. 3d. per oz. Standard Silver 4s. 8d. to 4s. 10d. (variable).

PRIZES AWARDED BY THE TURNERS' COMPANY FOR TURNING IN STEEL, BRASS, AND GOLD FOR HOROLOGICAL PURPOSES.

ON Friday, the 12th ulto., the prizes awarded by the above-named company for turning in ivory, pottery, stone, jet, and in steel, brass, and gold (for horological purposes), were distributed to the successful competitors by the Lord Mayor at the Mansion House, in the presence of the Lady Mayoress and a numerous assembly. After the proceedings had been opened by the Master of the Turners' Company, the Lord Mayor expressed his regret at the absence of the Baroness Burdett-Coutts, who was a large contributor to the fund from which the prizes came. He considered the exhibition which had preceded the award of prizes, and the ceremony at which the assemblage before him was assisting, very satisfactory proofs of the interest taken by the Turners' Company in the all-important subject of education. Brief addresses were then delivered by several of the judges, who were able to speak in high terms of the skill shown by some of the competitors. Mr. Doulton, the judge of pottery turning, said there was a grand future before the City guilds if they would only rise to a sense of their moral responsibility. The cultivation of higher art required for its encouragement the establishment of an institution of the nature of an industrial university. Mr. V. Simons, judge of stone and jet turning, and Mr. John Jones, one of the judges of steel, brass, and gold work, having also addressed the company, the prizes were delivered by the Lord Mayor, the first in ivory being handed to Mr. John Hegley; the first in pottery, with the freedom of the Turners' Company, to Mr. E. Bryon; the first in stone and jet, with the freedom of the company, to Mr. J. Nankervis. The prizes for turning in steel, brass, and gold for horological purposes were as follows :—

First Prize.—Silver Medal and Freedom of the Company to Mr. Charles Crisp, 91, Brighton Road, Stoke Newington, for several beautiful specimens of turning, they being numbered one, two, and three, respectively.

No. 1 was a somewhat minute hardened and tempered steel balance and balance-staff, with chronometer rollers; the balance being made in imitation of a compensation balance. The whole piece, balance-staff, and rollers, being suspended within a hardened and tempered steel circle; the circle being attached to a fancy and original designed pedestal, also of hardened and tempered steel. The whole of this piece of work being wrought up to a brilliant finish, the eye is somewhat dazzled, and scarcely knows where to rest; but after a while we are enabled to look at and admire the various points. The first thing that struck us was the fine and just proportion of all the parts, there being a total absence of anything clumsy or ill-formed. The discharging pallet being about one-third the diameter of the impulse pallet, with its minute jewel just peeping over its edge. The impulse roller, with its finely cut notch, and well fitted stone, appearing as good a proportion to the diameter of the balance. The seat of the balance is polished on the top, and also gently sloped to meet the roller. The back cuts to the pivots are nicely turned and polished, the upper one being a fine specimen of a perfectly flat shoulder, with conical pivots well proportioned. The steel balance is finely crossed out, all edges taken off, and the inside as well as the outside of the imitation laminæ being polished quite flat. The balance has, we believe, a full complement of screws; but we noticed a peculiarity about them, each of them (timing screws excepted) having a nicely shaped conical pivot at the end, finished and burnished; as the screws are hardened and tempered, these pivots must have been made after the screw was completed.

The next thing that engaged our attention was the steel circle that the balance and staff is suspended in. This is a novelty, and a proof of skilful handling, every portion of it, inside, outside, sides, and edges, being finely glossed, and perfectly square and true. The pedestal is a prettily designed piece of work, in perfect harmony with the rest, and skilfully executed.

The specimen marked No. 2 was a chronometer balance staff and rollers, made out of *one solid piece of steel*, and worked into the "frame," right depth to wheel, end shakes and heights. At a first glance, there is nothing to indicate its being made out of the "solid," and is evidently worked to resemble a staff made in pieces. The faces of the rollers are "well up" and quite flat, and at first there is no reason to doubt that they are polished in the usual manner; but on a closer inspection, it is evident they have been done by a circular motion. This piece of work is also mounted in a circle, on a suitably designed pedestal, differing somewhat from the other.

The next special piece, marked No. 3, is a very small escape pinion of 8 leaves (prettily mounted on a hardened and tempered steel pedestal), with a deep and cleanly cut hollow, out of which a conical pivot seems to grow. This is a specimen of turning from the "graver."

In addition to the three pieces described above, under another glass shade was a complete pocket chronometer escapement, displaying a style and finish rarely met with.

Second Prize.—The Bronze Medal to Mr. Heyes, Palmerston Road, New Wimbledon, for a marine chronometer escapement. We much regret, for this prize-man's sake, that his work was left in the "frame," we therefore cannot describe it, beyond stating that it was entered as perfectly true, square, well-proportioned, and finished, and as such, complimented by the judges.

Third Prize.—First Certificate of Merit and £4 to Mr. Richard Bridgman, 89, Neville Road, Stoke Newington, for specimens of two double roller lever escapements, a 20 size $\frac{3}{4}$, and a 4 size $\frac{3}{4}$, the greatest novelty of which was that the whole of the turning was entirely left as from the cutter. The balance-staff and pivots, the scape pinion and pivots, the pallet-staff and pivots of both escapements were left entirely as they came from the cutter, neither polishing, burnishing, nor any other means being used to improve their appearance in any manner. On close examination of all the pivots of both escapements we greatly admired their smoothness and the manner in which they are turned to fit the jewel holes, with just that requisite freedom required, and also that they were left by the cutter so perfect, that they could not be improved by polishing, burnishing, or any other process, and we were informed that a similar piece of turning has not before been accomplished either in this country or abroad. The competitors' reason for leaving both specimens as from the cutter was that he understood that the competition to be principally for superiority of pure hand turning, and that by polishing any part the judges would not be able to form an opinion as to the merits of the actual turning, it being well known that polishing invariably removes all traces of rough and bad turning. The escapement to the 20 size is called an anchor escapement, on account of the peculiar shape of the fork of the lever, which acts upon a triangular stone in the impulse roller, the breadth of the stone being the number of degrees of impulse that the balance receives, which causes the unlocking to take place in line of centres. The lever is made of gold. We noticed a great improvement in the gold banking studs of both escapements. Instead of being steady pinned to the lever, as is mostly the case, they are fitted into a square hole in the lever, and kept secure by a screw (a very delicate piece of work). By this means the workman dispenses with that part of the stud which holds the steady pin. They are therefore much lighter and stronger. Both escapements have what may be termed horse-shoe bankings (flush with the plate), the advantage of which is, that the same lockings are always maintained. No matter into whose hands the watch may go, its turning properties will not be affected by bent bankings, and they also add to the superiority of the escapement.

Fourth Prize.—SECOND CERTIFICATE OF MERIT AND £3 to Mr. Charles Curzon, 15, Stamford Road, South Tottenham, for an exhibit consisting of four escapements—viz., double roller, single ditto, and two of Savage's construction, all interchangeable (each change entirely altering the character of the escapement), only requiring the removal of the rollers in each case. All the rollers fit up to the collet of the balance-staff. The levers, with pallets and pallet-staff, are perfect in themselves, so that their removal is simple; then each escapement is complete in itself. No. 1.—The double roller is made with pallets of 8½°, locking on depth 1½°, proportion of lever and roller 3 to 1, making 25° at the balance. No. 2 (the single roller).—This is made in the best form; the impulse pin is half round, and the hole in the roller is made to fit it, so that the passing hollow is in the place the pin would occupy if the hole was round, thereby securing as round a roller depth as is possible with an arc of 30° at the balance. It has pallets of 10°, depth 2°, proportion of lever and roller 3 to 1. No. 3 is the two-pin, on Savage's principle (jewelled). This escapement is as two levers and rollers, in the proportion of 3 to 1 for the unlocking, and 2½ to 1 for the impulse. The pallets have 12°, locking or depth 2°, and make 30° at the balance. No. 4 is also of Savage's construction, but with long arc pallets of 14°, depth 2°, unlocking leverage 2½ to 1; impulse ditto, 2 to 1—making 31° at the balance. No. 5 is a balance-staff, pendulum, collet, and pair of rollers left from the graver. They have all been tested in the "Lever Escapement Angle-Meter," invented by Mr. Bridgeman. The advantage of changing the escapements is that when the watch is complete and its rate taken (say for three or six months) with escapement No. 1, escapement No. 2 can be put in, and its rate taken for an equal period; and so on till the four have been tested. In this way they will all be tested under the same condition of motive power, balance, and pendulum-spring; and, indeed, all that may affect the one will affect all in like manner.

Fifth Prize.—THIRD CERTIFICATE OF MERIT AND £2 to Mr. B. W. Warwick, 66, Britannia Road, Islington, for a clock lever escapement on platform. Four holes jewelled in sapphire. The angles to which the escapement is worked are—Drop-hold on outside pallet, 1°; drop hold on inside pallet, 1°; total angle of each impulse-surface, including drop-hold, 10°; total angle made by lever between banking-pins, from pallet-staff centre, 14°; the angle of "draw" by the tooth of the escape-wheel on each pallet, 2°; the angle made by the roller from one (unlocking) to the next (locking), 33°; total angle made by roller from entering to leaving lever-notch, 47°. The 10° made by the pallets bears the same relation to the 33° made by the roller that the total angle of 14° by the pallets does to the total angle of 47° by the roller, nearly. 10° : 33° : : 14° : 47°, nearly. The balance-staff is all steel, and is polished all over. The roller is polished all over. The total weight of the compensation balance, 88 grs.; diameter of C. balance, 32 mm. The escape pinion is polished all over with polished hollows; it is a pinion of 8. Diameter of pinion, 5 mm. The pallets are jewelled in high-coloured sapphire; the pin in the roller is also sapphire; the pivots of the pinion and balance-staff are conical, with polished back cones.

Sixth Prize.—£2 to Mr. Alfred Shalcross, 69, Oakley Road, Islington, for a good specimen of duplex escapement with a jewelled impulse pallet. In submitting the duplex escapement, the balance-staff of which is the most delicate portion of turning of any escapement, the competitor forwarded it in different forms, as follows:—

"No. 1, jewelled pallet duplex escape complete.

"No. 2. Duplex balance-staff pivoted to same frame, without pallet, roller, or roller-cap, to show the truth and finish of the staff alone.

"No. 3. Duplex balance-staff pivoted to same frame, as left from the graver untouched by file, polisher, or burnisher.

"No. 4. Ruby roller that staff No. 3 was turned to.

"No. 5. Double roller lever escapement."

Duplex escapements of good execution were also sent for competition under the motto "*Perseverardo.*"

Seventh Prize.—£1 to Mr. T. Withers, 157, Packington Street, Islington, for a two-day chronometer gimbal, highly finished and lacquered; and two brass boxes for two-day marine chronometer, one turned and finished off with emery paper; the other left untouched by any smoothing process.

Eighth Prize.—CERTIFICATE OF MERIT AND £5 (special prize for apprentices) to Mr. C. J. Curzon, for a double-roller escapement to a ¾ plate movement with spring bankings; and a specimen of hand turning, consisting of a pair of rollers, solid balance-staff and pendulum collet, as well as a solid balance-staff—a pocket chronometer balance-staff and a pair of rollers.

Ninth Prize.—£2 (special prize for apprentices) to Mr. James K. Curzon, for a solid balance-staff and rollers, (separately polished). The same in one solid piece (polished). Three turned balance-staffs in one piece joined together by the pivots left from the graver, and a chronometer staff and rollers (polished).

We are much gratified at the opportunity thus afforded to workmen by the Turners' Company. One great advantage of such competitions, held at different intervals, is that they present opportunities for young men of ability to bring themselves forward where otherwise they might remain for years in obscurity, since ability often requires aid to be developed. We congratulate the Turners' Company on the complete success of the undertaking, and hope to see their example followed by other guilds.

CORRESPONDENCE.

It must be distinctly understood that we do not necessarily identify ourselves with the opinions or views of any of our Correspondents. Our pages are alike open to all for free discussion of questions connected with the various trades which we represent, and all Correspondents will find every opportunity afforded them for expressing their opinions.

TAXATION OF SILVER PLATE.

To the Editor of the WATCHMAKER, JEWELLER, & SILVERSMITH.

SIR,—From numerous letters which have reached me with reference to the proposal to abolish the silver duty, I find that a very general belief prevails that the abolition of the tax upon silver manufactures would necessarily do away with the Hall mark, involving the loss to the public of the sense of guarantee which that mark conveys.

The following information may be of service as showing that the Hall mark has prevailed, uninterruptedly, for 577 years; that it was instituted 419 years before a duty was thought of; that it continued during the abeyance of taxation from 1758 to 1784; the inference being that it may, and probably will, continue for centuries after the abolition of taxation.

Hall-marking dates from A.D. 1300. 28 Edward I. c. 20, commonly called "Articule super cartas." It ordained that "none work worse silver than money; that no manner of vessel depart out of the hands of the workers until it be assayed by the wardens of the craft; and further, that it be marked with the *leopard's head.*"

In A.D. 1327, 1 Edward III., bearing date the 30th March, the first charter was granted to the Goldsmiths' Company, empowering the Company to punish offenders. The Company's ordinances of 1336 enjoin "that silver work shall be brought to the Hall to be assayed, and that such as will bear *the touch* shall be marked with the owners' and sayers' marks and with the Liberdshede crowned." The mark of the lion was added about the year 1545. The King's head, the duty mark, was added in 1784, when the duty was reimposed.

Duty first became payable in 1719, and it was repealed in 1758.

Members of the trade therefore need be under no apprehension that the abolition of the duty will in the slightest degree affect Hall marking, beyond the withdrawal of the Queen's head, or duty mark.—I am, Sir, your obedient servant,

Pall Mall East, Oct. 30th. EDWARD J. WATHERSTON.

TABLE FORKS.

(Continued from page 33.)

IT is, we repeat, very remarkable that the fork, which did so much for the simplification and advancement of the national *cuisine,* by encouraging the taste for solid viands and natural juices, should, as Dr. Jeafferson remarks, have continued so long unknown. Particularly so as about the time of Elizabeth, who herself liked "a cut of roast," this taste was becoming more general. The "delicate slice," with the pungent accompanying horse-radish, was a thing unknown to the ancients, who fingered their "gobbets" or spooned their "dices" of meat in a way that would disgust us moderns. Indeed, it is frightful to think how they must have bedaubed their long beards and togas in conveying food from the table to the mouth without forks. Even in olden England, dining must have been a distressingly sloppy process, when the *rude feaster* "grabbed" the choicest bits from dishes brimming with thick gravy; and the *nicest feeder,* after taking a "gobbet" of flesh, dipped it into the sauce-boat before he carried the dripping morsel over the tablecloth to his lips. Certainly "the roast beef of Old England" never had the honour due to its merits until the introduction of forks enabled the carver to cut it properly.

In ancient times, as we have observed, and as the practice still is in the East, meat was commonly prepared as stews; or, if roasted, was cut into small pieces by a carver, so as to be easily taken in mouthfuls by the guests, who used the fingers and a knife for the purpose. The carver was an official of some dignity (in his own conceit). We have seen a book of some rarity, dated 1581 (Venetia), compiled by one of these officers of the household, entitled, "Il Trinciantanti di M. Vinzenzo Cervio;" or, as he styles himself, Carver to Cardinal Farnese. In this book he speaks of, and gives cuts of, double-pronged forks, and also of a three-pronged fork for eating fruit (*forcini par li frutti*), from which it is plain that forks were used in France and Germany before they were introduced into England. His Chapter V. contains a full discription of the beau-ideal of a fork, which, if it were not for fear of wearying our readers, we should be tempted to translate. It must, however, be observed, that the utensils, of which engravings are given, seem rather adapted for carving than for general service. The learned antiquarian Douce refers to this book, in "Archaelogia," vol. xii.

Another necessary attendant dignitary at the dinner-table was the Ewerar or Ewary, who, with a set of subordinates, attended at meals with basins, water, and towels; for none even of the sovereigns in England, until after the reign of Henry VIII., had forks, but all, high and low, used the fingers in eating. The office of ewary, however, continued some time after this article had come more generally into use.

Italy has, as we have previously indicated, the merit of having introduced this useful article to Europe. A traveller named Thomas Coryate, who visited that country about the commencement of the 17th century, appears to have been the first who introduced them into England as an article of domestic utility. His travels, which he himself entitled "Coryate's Crudities," were first published in 1611. They were subsequently republished in 1776. We extract the following, as referring to the subject of our remarks: "I observed a custom in all those Italian cities and townes through which I passed that is not used in any other country that I saw in my travels; neither do I think that any other nation of Christendome doth use it, but only Italy. The Italian, and also most strangers that are commonest in Italy, do alwaies at their meales use a little forke when they cut their meate. For while with one hande they cut the meate out of the dish, they fasten their forke, which they doe holde in their hande, upon the same dish; so that whatsoever he be, that sitting in the company of any others at meate, should unadvisedly touch the dish of meate with his fingers, from which at the table do cut, he will give occasion of offence to the company, as having transgressed the lawes of good manners; so much, that for his error he shall be at the least brow-beaten, if not reprehended in wordes. This form of feeding, I understand, is generally used in all places of Italy, their forkes being for the most part made of yron, steele, and some of silver, but these are used only by gentlemen. The reason for this their curiosity is, because the Italian cannot by any means endure to have his dish touched with fingers, seeing that all men's fingers are not alike cleane. Hereupon, I myself thought good to imitate this Italian fashion, by this forked cutting of meate, not only while I was in Italy, but also in Germany, and oftentimes in England, since I came home; being once quipped by a certain learned gentleman, a familiar friend of mine, Mr. Lawrence Whitaker, who in his merry humor doubted not to call me at table *furcifer*[*] only for using a forke, and (as Coryate naively observes) for no other cause."

Our readers will no doubt be surprised that so much "fuss" should have been made respecting the introduction of this now indispensable necessity of the table; but they can hardly conceive the prejudice which they had to encounter, and which for some considerable time impeded their general use. Fynes Morison, in his "Itinerary," advising all young travellers, urged them on "returning home, to lay aside the fork of Italy," as well as "the affected gesture of France, and all strange apparel." Will it now-a-days be credited that this prejudice existed among even educated persons, and indeed so much so that one divine actually preached against the use of forks, as being an insult to Providence not to touch one's meat with one's fingers. Something like this was the feeling excited at the innovation of that equally useful article, the umbrella, and of many other novelties previously unknown to the commonality.

It was, therefore, by slow degrees that forks made their way in English households. Even until the middle of the 17th century they were found only on the tables of the higher classes. Heylin, in his "Cosmographie" (1652) says, "The use of silver forks is by some of our spruce gallants taken up of late." About the period of the Restoration few noblemen had more than about a dozen forks of silver, along with a few of iron or of steel. This was the more remarkable; and, as a French writer, observing the introduction of this article into his nation, remarks, "Apparently up to this time, when they came into use, the knife was employed to carry the food to the mouth, as it still is in England, where for that purpose the blades of knives are made broad and round at the end." Fancy that, ye Belgravians!

Gradually steel forks for general use became an article of manufacture at Sheffield. At first they had but two prongs, and it was only in later times that the three-pronged kind was introduced. Sheffield, by the bye, was early noted for its cutlery. Thus we find in Chaucer (The Reeve's tale, l. 13), where he states of the Miller of Trompyngtoun, "A Scheffeld thwitel bar he in his hose."

As late as the early part of the 18th century table-forks, and, indeed, also knives, were so limited in numbers at inns in the North Country, that it was customary for gentlemen to carry with them a portable knife and fork in a shagreen case, and to this day a small knife and fork form part of the ornamental equipment of a Highland dress. We remember to have seen such a useful instrument, with also an accompanying spoon, at more than one pic-nic party. The general introduction of silver forks into Great Britain is comparatively recent: it can scarcely be dated farther back than the opening of the Continent to English tourists, at the termination of the French war in 1814. The extensive use of these costly articles, which quickly ensued, marks in an extraordinary way the rapid progress of wealth and refined taste throughout the United Kingdom. Nor can it be said that this was in any way diminished when the subsequent introduction of Albata or British Plate, and of German silver, and still more recently when the marvels of electro-metallurgy have brightened the table of many of a humble homestead.

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[*] Furcifer, in its serious meaning, was a term of reproach, used by the Romans to those slaves who as a punishment were fixed to a framed fork (furca) or yoke resembling an inverted V, and which for some offences they were condemned always to carry about with them. It is equivalent to rascal, villain, scoundrel, one who deserves the gallows.

"In a museum of social curiosities," says Dr. Jeafferson, in his "Book about the Table," "a large cabinet might be filled with single specimens of the various forks commonly used by our ancestors between the days of Anne and Victoria. There were forks with any number of prongs between two and six. Usually made of steel, they had handles of several materials and half a hundred diversities of shape. Forks with green, yellow, and pink handles, as also of painted porcelain, have disappeared, and the steel table-fork has become almost an obsolete thing in these days of sham silver. The few forks of Heylin's time were for the most part of silver. But the silver fork was somewhat rare till the beginning of the present century." "Indeed," adds the amusing writer, "so late as thirty years since, the introducers of the silver fork amongst our provincial commonality encountered no little opposition. 'Waiter, take away that thing, and bring me a fork,' a foxhunting squire once said in our hearing, at a hunt dinner. The 'thing' which he rejected was a silver fork."

Two or three French expressions spring to mind while compiling this article. Every one knows the meaning of *Déjeûner à la fourchette*, but few may be aware that *Hazard de la fourchette*, so frequent in the low kitchens of Paris, is identical with the ancient custom alluded to in 1 Samuel ii. 13, 14; though in the first case the result was not always so appetising as in the latter. *La fourchette du père Adam* will be best understood by digitary induction.

In Chambers's "Book of Days," p. 273, vol. ii., are engraved three specimens of antique forks, said to be in the collection of Lord Londesborough. The second example is curious: it is a German fork, believed to be a work of the 16th century. It is two-pronged of course, none others having been thought of. It is surmounted by the figure of a fool or jester, holding a saw. This figure is jointed like a child's doll, and tumbles about as the fork is used; while the saw slips up and down the handle. It proves, therefore, that this fork was used only as a luxurious toy.

Speaking of Lord Londesborough's Collection, we would wish to inform our readers that an illustrated descriptive catalogue of this collection of antique plate was printed for private circulation in 1860, by Frederick W. Fairholt, F.S.A. It would be a desirable acquisition to any manufacturing gold or silversmith, particularly to any who might be desirous of imitating "the quaint imaginings of the olden workmen, and the bizarre taste of their employers."

With this remark we close our notice of "Table Forks," hoping however to supplement it at a future time with a practical description of the manufacture of this now necessary and useful article.

COMPARISON OF THE DIFFERENT THERMOMETER SCALES.

	Fahrenheit.	*Celsius.*	*Reaumur.*
Freezing ...	32°	0°	0°
Temperate ...	48	$8\frac{8}{9}$	$7\frac{1}{9}$
Agreeable ...	64	$17\frac{7}{9}$	$14\frac{2}{9}$
Very Warm ...	80	$26\frac{6}{9}$	$21\frac{3}{9}$
Blood Heat ...	96	$35\frac{5}{9}$	$28\frac{4}{9}$
Fever Heat ...	112	$44\frac{4}{9}$	$35\frac{5}{9}$
Water Boils ...	212	100	80

DR. SAMUEL PARR had preached the Spital sermon at Christ Church on the invitation of the Lord Mayor of London, and as they were coming out of church together, Parr asked him how he liked the sermon. "Why, doctor," replied his lordship, "there were four things in it that I did not like to hear." "State them." "Why, to speak frankly then, they were the quarters of the church-clock, which struck four times before you had finished."

CURIOSITIES OF CLOCKS AND WATCHES.

(Continued from page 78.)

IN a Royal Household book, temp. Henry VIII. and Edward the VI., preserved among the records of the Court of Augmentations, now deposited at the Rolls, are inventories of certain valuable effects belonging to Henry VIII. in the Palace of Westminster in 1542. Among the effects were the following clocks:—

"Item, oone Clocke of iron with a case of glasse, the frame of the same case being iron gilt with iij plumettes of led and two belles whiche stryketh the quarter and half an hower.

"Item, oone Larum or Watch of iron, the case being likewise iron gilt, with two plumettes of led.

"Item, oone Clocke of copper and gilt, with a man in the toppe of the same of like copper, holding the King his armes sett in silver and gilt, standing upon a fote of walnuttre garnishid with xij pillours of like wodde.

"Item, oone Clocke of iron with a Larum to the same, with the Kinge's armes crownyd upon the same, with iij counterpoyses of copper, two of them wrythen and gilt, and the iij de playne and nott gilt, with iij smaller counterpoyses of like copper and gilt.

"Item, oone Clocke of iron having doors of copper and not gilt, with iij belles and two men that stryketh the hower, and upon the top of the bell an egle gilt sett upon a case of iron colourid red, with iij great plomettes of copper and iij smale plumettes to the same, and the same clock having the chainge of the moone upon it.

"Item, oone Clocke of copper and gilt, with a chyme to the same, showing all the daies of the yere and the planettes, with iij moving dialles to the same, oone of them beyng silver enamuled blewe and the xij signes gilt, with thre great counterpoyses of copper gilt, and iij very smale counterpoyses of like copper gilt.

"Item, oone Clocke of copper and gilt, with a chyme to the same, at the half hower, having the chainge of the moone, the Kinge's armes graven upon the ij dores, with iij great plumettes of copper gilt, engraven with the Kinge's and Quene Anne's letters, and two smale plumettes like acorns gilt, and the iij de wrethen all gilt.

"Item, oone rounde Clocke of iron, with sondry dores of copper graven, showing howe the see dothe ebbe and flowe, with a case of glasse sett in iron gilt, standing upon a foote or case of wodde, with iij great counterpoyses and two smale of copper, and the iij de smale oone being of led.

"Item, oone Clocke of iron, with a Larum to the same, stryking butt oone stroke at the half hower, with a case of glasse sett in iron gilte and payntid, with iij great and iij smale plomettes of led.

"Item, oone Clocke of iron garnisshid with copper and gilt, with a George upon the top of the same, which clocke goyth withowte any counterpoyse."

Sir Anthony Denny, to whose charge the effects enumerated above were entrusted, as keeper of the Palace of Westminster in 1542, appears to have presented to Henry VIII. a very singular clock as a New Year's gift. It was designed by Holbein, whose drawing, purchased by Horace Walpole at the sale of Mariette's collection, was exhibited to the Society of Antiquaries by Mr. Graves in 1848. It had on its summit a clock driven by wheelwork, below which were before and afternoon dials, showing time by shadows; and beneath them was a clepsydra, indicating the quarters of an hour by means of a fluid.—*(To be continued.)*

THESE lines are inscribed under the clock in front of the Town Hall in Bala, Merionethshire:—

Here I stand, both day and night,
To tell the hours with all my might;
Do you example take by me,
And serve thy God as I serve thee.

THE

Watchmaker, Jeweller, & Silversmith,

A MONTHLY TRADE JOURNAL,

Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at MILNERS' BUILDINGS, MOORGATE STREET (OPPOSITE MOORGATE STREET STATION), LONDON, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

3923. ARTHUR GAVED PHILLIPS, of 20, Canning Street, Liverpool, Lancashire, for an invention of "Improvements in extracting silver from copper precipitate."—Dated 24th October, 1877.

3947. FRANK BISHOP, of Soho, in the county of Middlesex, for an invention of "Improvements in stands for stereoscopes and graphoscopes."—A communication to him from abroad by James Cremer, of the city of Philadelphia, in the state of Pennsylvania, United States of America.—Dated 25th October, 1877.

Notices to Proceed.

2720. GEORGE LUND, of the firm of Lund and Blockley, 42, Pall Mall, in the city of Westminster, Manufacturers, has given notice in respect of the invention of "Improvements in apparatus for synchronizing or setting clocks or other time-keepers."

2324. CHARLES WILLIAM COOPER, of Birmingham, in the county of Warwick, Electro-plater and Gilder, and REUBEN CORNELIUS LILLY, of Birmingham aforesaid, Jeweller, have given notice in respect of the invention of "Improvements in watch protectors, which improvements may also be used for protecting lockets, charms, chains, and other like articles of jewellery."

Grants of Provisional Protection for Six months.

3540. To RICHARD HOOPER ALLEN, of Handsworth, in the country of Stafford, Jeweller, for the invention of "An improved fastening for solitaries, applicable also for purses, bags, and other like articles."

3605. To WILLIAM FREDERICK SPITTLE, of Birmingham, in the county of Warwick, Manager of Works, and WILLIAM PEARCE, of Handsworth, in the country Stafford, Manufacturing Jeweller, for the invention of "Improvements in solitaires, sleeve links, and other like fastenings."

3627. To GEORGE WILLIAM AMBRIDGE, of 2, Myrtle Street, Hoxton, London, N., Philosophical Instrument Maker, for the invention of "An improved kaleidoscope."

Patents Sealed.

1451. JOSEPH GEORGE ROLLASON, of the firm of Rollason, Wood, and Co., Stampers, Piercers, and Fancy Chain Manufactures, of Birmingham, in the county of Warwick, for an invention of "Certain improvements in solitaires and other like fastenings."—Dated 13th April, 1877.

1579. JOHANN ANTON BENEDICT VON CASTELBERG, of 58, Holborn Viaduct, in the city of London, for an invention of "Improvements in calendar watches."—A communication to him from abroad by Fritz Petitpierre, of Chaux de fonds, Switzerland.—Dated 23rd April, 1877.

1705. CHARLES HENARD, Manufacturer, and ETIENNE LASNIER, both of 1, Rue Laffitte, Paris, France, for an invention of "A new cosmographic clock."—Dated 2nd May, 1877.

2146 CHARLES DENTON ABEL, of Southampton Buildings, in the county of Middlesex, for an invention of "Improvements in buttons or studs."—A communication to him from abroad by Pierre Rousseau, of Paris, in the republic of France.—Dated 1st June, 1877.

1522. HENRY STUART, of Liverpool, in the county of Lancaster, Watch Manufacturer, and GEORGE DANIELS, of the same place, Watchmaker, for an invention of "Improvements in mechanism for winding and for setting the hands of keyless time-keepers."—Dated 19th April, 1877.

1548. JOHN UNWIN, of Sheffield, in the county of York, Manufacturer and Merchant, for an invention of "Improvements in the preparation and preservation of an electro-depositing solution of nickel."—Dated 20th April, 1877.

3258. NARCISSE SALMON and ALBERT DELAVIERE, both of Paris, in the republic of France, for an invention of "Improvements in shirt or sleeve studs, solitaires, and other analogous articles."—Dated 28th August, 1877.

1624. JOSEPH GEORGE ROLLASON, of the firm of Rollason, Wood, and Co., Stampers, Piercers, and Fancy Chain Manufacturers, of Birmingham, in the county of Warick, for an invention of "Improvements in sleeve-links and other dress-fasteners; which improvements are also applicable to other purposes."—Dated 26th April, 1877.

1639. HENRI ADRIEN BONNEVILLE, of the British and Foreigh Patent Offices, 18, Rue de la Chaussée d'Antin, Paris, France, and 6, Piccadilly, in the county of Middlesex, Patent Agent, for an invention of "Certain improvements in self-recording thermometers, hygrometers, and other instruments of a similar nature."—A communication from Robert Kirk Boyle, a person resident in the city, county, and state of New York, United States of America.—Dated 26th April, 1877.

3137. HENRI WILLIAM LEY, of Bear Street, in the county of Middlesex, for an invention of "Improvements in clocks."—Dated 17 August. 1877,

Designs Patented.

9969. HERMANN J. MULLER, of New York, N.Y., for "A clock-case."—Application filed 27th April, 1877.—Term of patent 7 years.

9993. HENRY J. DAVIES, of Brooklyn, N.Y., for "Clock and mirror frames."—Application filed 2nd May, 1877.—Term of patent 7 years.

10,020. GEORGE F. GLEASON, of Newark, N.J., for "An ornamental chain."—Application filed 2nd May, 1877.—Term of patent 3½ years.

10,026. MOSES STERNHEIMER, of New York, N.Y., for "A bracelet."—Application filed 9th December, 1876.—Term of patent 3½ years.

10,045. JAMES W. MILLER and ISAAC M. MILLER, of Newark, N.J., for "Studs and buttons."—Application filed 11th May, 1877.—Term of patent 3½ years.

10,049. CHARLES H. GRAEF, of Edgewater, N.Y., for "A bracelet."—Application filed 4th May, 1877.—Term of patent 3½ years.

Patents which have become Void.

3382. FREDERICK BULLIVANT BROWN, of Handsworth, in the county of Stafford, Jeweller, for an invention of "Improvements in sleeve links, shirt studs, solitaires, and other fastenings for articles of dress and jewellery."—Dated 3rd October, 1874.

3470. MICHAEL HENRY, of Fleet Chambers, 68, Fleet Street, in the city of London, Patent Agent, for an invention of "Improvements in pencil cases and other similar articles."—A communication to him from abroad by Alonzo T. Cross, of Providence, Rhode Island, in the United States of America.—Dated 9th October, 1874.

3600. JOSEPH GEORGE ROLLASON, of Birmingham, in the county of Warwick, and JOHN WOOD, also of Birmingham aforesaid, trading under the style or firm of Rollason and Wood, Machinists, Diesinkers, Stampers, and Patent Chain Manufacturers, for an invention of "Certain improvements in the construction and manufacture of solitaires, studs, and portable dress fasteners."—Dated 20th October, 1874.

Patents Granted in Foreign States.

FRANCE.

116,310. TINERE, for "A perpetual motion applicable as a motive-power to clocks and other machinery."—Dated 3rd January, 1877.

117,388. GARCIA, jun., for "Fusee-arbors for clockwork."—Dated 8th January, 1877.

116,396. LION, jun., of Paris, for "A motion for aneroid barometers."—Dated 8th January, 1877.

116,417. BRITTON, for "Improvements in the springs of watch-cases."—Dated 11th January, 1877

116,513. Berding, for "Bohemian stones for jewellery."—Dated 17th January, 1877.

116,569. Reclus, for "Improvements in aneroid barometers."—Dated 18th January, 1877.

116,573. Schwob Brothers, for "A remontoir for watches."—Dated 18th January, 1877,

116,727. Japy, Brothers, and Co., for "A machine for preparing or manufacturing metal screws, and chiefly screws for clock-work."—Dated 27th January, 1877.

116,737. Robottom, for "Improvements in keyless watches."—Dated 27th January, 1877.

116,743. Berger, of Paris, for "Animated jewellery."—Dated 30th January, 1877.

116,755. Drouillet, for "Self-acting and continuous magnetic barometers and thermometers with recorders."—Dated 30th January, 1877.

Certificates of Addition.

111,036. Guilment, for "A clock."—Dated 10th January, 1877.

113,747. Japy, Brothers, and Co., for "A calendar watch or clock."—Dated 11th January, 1877.

Patents Granted in Foreign States.

Belgium.

43,041. H. W. Ley, for an imported invention of "Improvements in clocks."—Dated 8th September, 1877.—(French Patent, 6th September, 1877.)

43,063. E. Courty, for an imported invention of "Applying nickel plate on copper, gold, &c."—Dated 11th September, 1877.—(French Patent, 21st July, 1877.)

43,101. A. Bois, of Brussels, for "A counter of revolutions, called 'rotameter.'"—Dated 15th September, 1877.

43,201. A. Lion, a Patent of Improvement for "Bracelets."—Dated 28th September, 1877.—(Original Patent, 2nd August, 1877.)

Austria.

18. F. Denwagner, of Vienna, for "Portemonnaies combined with a watch."—1 year.—(Public.)—Dated 5th June, 1877.

61. C. A. Mayrhofer, of Vienna, for "Improvements in pneumatic secondary clocks."—1 year.—(Public.)—Dated 21st June, 1877.

Bavaria.

21. A. Moser, of Aix-la-Chapelle, for "Improvements in telescopes for measuring angles."—2 years.—Dated 3rd February, 1877.

70. The Westphalian Wire-Works Company, of Hamm, for "A process and machine for the manufacture of spiral springs."—3 years.—Dated 30th April, 1877.

115. A. S. J. Pattus, of St. Croix, Switzerland, for "Remontoir clocks repeating the quarters, without wheel-work or hammer."—3 years.—Dated 20th June, 1877.

Wurtemberg.

51. V. Popp, E. Resch, and C. A. Mayrhofer, of Vienna, for "Pneumatic clocks."—Dated 7th April, 1877.

56. P. Ehrlich, of Gohles, for "An apparatus for musical boxes."—Dated 7th April, 1877.

65. C. Riefler, of Maria-Rhein, Bavaria, for "A contrivance in compasses."—Dated 25th April, 1877.

69. T. Weisser, of Villingen and Furtwangen, Baden, for "Connecting a calendar-clock with a common clock."—Dated 25th April, 1877.

101. The Westphalian Wire-Works Company, for "A machine for the manufacture of spiral springs."—Dated 9th June, 1877.

United States of America.

190,488. Wm. S. Hicks, of New York, N.Y., for "Combined watch-chain bar and button-hook."—Application filed 16th March, 1877.

190,518. Rudolf Sayer, of New York, N.Y., for "Clock-alarms."—Application filed 5th April, 1877.

190,530. C. Yocco, of San Jose, Cal., for "Spectacles."—Application filed 12th March, 1877.

190,671. Henry J. Davies, of Brooklyn, N.Y., for "Clock-dials."—Application filed 27th February, 1877.

191,140. W. A. Hammond, G. P. Hammond, and W. Kyrmer, of Brooklyn, N.Y., for "Bracelets."—Application filed 7th May, 1877.

191,149. F. P. Iannarone, of Washington, D.C., for "Eyeglasses."—Application filed 6th December; 1876.

191,338. Geo. W. Harris, of Sturgis, Mich., for "Watch-keys."—Application filed 20th January, 1877.

191,344. J. S. Horton, of Jamestown, N.Y., for "Sleeve-buttons and studs."—Application filed 10th February, 1877.

191,39[illegible]. M. Zacharias, of San Francisco, Cal., for "Stud-fastenings."—Application filed 30th March, 1877.

191,630. William F. Wuterich, of Meriden; Conn., for "Devices for adjusting the position of clocks."—Application filed 25th November, 1876.

191,665. A. M. English and W. W. Covell, of Providence, R.I., for "Manufacture of plated jewellery."—Application filed 14th April. 1877.

191,897. F. A. Stohlmann, of Brooklyn, N.Y., for "Thermometers."—Application filed 25th April, 1877.

192,118. D. J. Gale, of Bristol, Conn., for "Calendar-clocks."—Application filed 30th May, 1877.

192,167. Edward Huguenin, of Philadelphia, Pa., for "Methods of ornamenting metallic surfaces for jewellery."—Application filed 30th April, 1877.

192,222. Edward G. Boynett, of Jersey city, N.J., for "Watches."—Application filed 2nd May, 1877.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Harris, Simon, Union-street, Cambridge, jeweller. Oct. 10. Fetch and Jarrold, sols., Cambridge.

Jones, William Augustus, and David Jones, 46, Pall Mall, and 18, East-street, Brighton, jewellers. Oct. 13. J. K. Nye, solicitor, Brighton.

Jones, David, Pentre and Heolfach, Glamorganshire, watchmaker. Oct. 12. At Hollier and Williams', sols., Pontypridd, Nov. 2 at 3.

Lines, Frederick, 69, Spon End, Coventry, watch finisher. Oct. 9. Hughes and Masser, sols., Coventry.

Rivers, Hny. Beale, Peverill-street. Nottingham, jeweller. Oct. 10. F. Acton, sol., Nottingham.

Harrison, Jas., Haltwhistle, watchmaker. Carrick, Lee and Sons, sols., Haltwhistle.

Bacon, John Francis, Swaffham, Norfolk, watchmaker. Oct. 15. A. Kent, sol., Norwich.

Jack, Joseph, Gas-street, Coventry, watch jeweller. Oct. 16. Hughes and Masser, Coventry.

Shrieber, Wm., Maesteg, Glamorganshire, jeweller. Oct. 16. G. Walker, sol., Bridgend.

Wilkinson, Thos., 48, Northampton-street. Birmingham, manufacturing jeweller. Oct. 17. Rowlands and Bagnall, sols., 25, Colmore-row, Birmingham. 6 at 3.

Austin, Chas., 42, Clapham Park-road, late Tooting, and 15, Lower Marsh, jeweller, &c. W. E. Goatly, sol.

Wilkinson, Thos., 48, Northampton-street, Birmingham, manufacturing jeweller. Oct 23. At Rolands and Bagnall's, sols., 25, Colmore-row, Birmingham, Nov. 12 at 3.

Trustees Appointed.

Ann, Robert H. (Bkt.), Vittoria-street, Birmingham, and Church-view, Handsworth, jeweller. Tr., C. E. Cowie, Bennett's-hill, Birmingham, accountant.

Meetings.

Ward, Geo. (Bkt.), Camberwell-road, jewellery salesman. At Bktcy. Ct., Lincoln's Inn-fields, Nov. 6 at 11, exam.

Dividends.

Williams, Alfred (Bkt.), Hartington-buildings, Birmingham, jeweller. 1st and final div. $1/1\frac{1}{8}$; S. Dominy, 24, Waterloo-street, Birmingham.

Distributions of Assets.

Greenhalgh, Mary A., 16, Plymouth-grove, Chorlton-upon-Medlock, Manchester, late Accrington, jeweller, died Dec. 24, 1876. Clms. by Nov. 30 to Smith and Boyer, 34, Brazennose-street, Manchester, sols.

Cass, Edward, Darlington, clock and watch maker, died Nov. 16. Clms. by Nov. 1. to O. B, Wooler, Darlington, sol.

Last Days for Lodging Claims.

Behrens, Louis, trdg. as J. Behrens and Son (Bkt.), Deansgate, Manchester, jeweller. Clms. by Nov. 5 to H. Kidson, St. James'-sq., Manchester, accountant.

Douglas, Jas., 96, Argyle-street, Glasgow, goldsmith, &c. Tr., J. Miller, 71, Queen-street, Glasgow, Nov. 9.

Sequestrations.

Watt, Robert Don, Elgin, watchmaker. Oct. 24, with protn. Tr., and Com., Gordon Arms Hotel, Elgin, Nov. 7 at 4. Clms. by Feb. 24. Agent, C. D. Mitchell, Dundee, sol.

INTERESTING FACTS ABOUT METALS.

PLATINUM, the densest of the ordinary metals, possesses also one of the highest points of fusion. The metal fuses when exposed to the heat of the oxyhydrogen blowpipe. When in the state of very fine wire, it may be melted into small globules by the heat of an ordinary mouth-blowpipe, and is quite readily fused in very small quantities by the aid of a hot blast supplied to an ordinary Bunsen gas-flame.

Platinum belongs to the class of metals which soften before they attain perfect fluidity. This peculiarity gives it the valuable property of welding, or the uniting of surfaces without the use of solder, and enables the finely divided metal, technically termed the metallic sponge, to be wrought into a solid and compact bar. Platinum is not known to be volatile, though perhaps, at sufficiently high temperatures, it, in common with all substances, would be vaporised. Platinum does not combine directly with oxygen, and therefore would not be wasted during the process of melting.

Gold melts at about 2,016° to 2,190° F., according to different authorities. It is neither affected by water nor air at any temperature, and is not attacked by ordinary acids. It is the most malleable of all the metals, and may be beaten into sheets of surpassing wonderful thinness. Its very great malleability renders it unfit for use for jewellery or for coinage, until its hardness and consequent durability are increased by alloying it with silver or copper. Exposed to the heat of the oxyhydrogen blowpipe, it is known to be vaporised, and it was formerly supposed that it was not volatile at lower temperatures, but the researches of Napier and Makins show that volatilisation occurs at temperatures of an ordinary muffle furnace when alloys of silver and gold are cupelled with lead. An analysis of deposits taken from the chimney of a small reverberatory furnace, in daily use for cupelling gold for months, showed 14 per cent. of silver and 7.1 grains of gold for every 8 ounces of silver. Still, after the destruction of a lot of jewelllery by a fire, a great proportion of the gold should be recoverable, since but a small quantity, if any, would be volatilised; and the metal is not at all affected by air or water, as before remarked.

Lead melts at about 630°F. Unlike gold, it combines readily with the oxygen of the air, forming various oxides—mainly litharge, a product of the direct oxidation of the metal. When melted and exposed to the atmosphere, it absorbs oxygen very rapidly; so that, unless caution be exercised in melting, it is apt to waste from the direct oxidation, and especially from the fact that, at a white heat, it boils and volatilises. When in a very finely divided state, metallic lead combines so rapidly with oxygen that it takes fire while falling through the air, and burns with a red flash. This metal possesses the valuable property of welding in the cold, provided the surfaces joined are clean and free from oxide. Lead forms alloys with nearly all the metals. Many of its alloys are of great value. It alloys but imperfectly with copper, cobalt, nickel, and iron. The following are some of the more important alloys. :—

Alloys.—Type Metal, an alloy consisting of 83 parts of lead and 17 parts of antimony, with sometimes a little zinc. This alloy heated in the air, rapidly loses its antimony by oxidation —the antimony oxidising at a lower temperature than the lead; the oxide resulting from the action always contains, however, according to Watt, a large percentage of the oxide of lead.

Stereotype plates sometimes contain $\frac{3}{4}$ part tin; music stereotype plates contain, tin 12 parts, lead 7 parts, and antimony 1 part. The general composition of ordinary stereotype plates is, lead 70 parts, antimony 15 parts, and bismuth 15 parts. This alloy expands on cooling, and is therefore applicable for casting stereotype plates.

Rose's fusible alloy, formed of 2 parts of bismuth, 1 of tin, and 1 of lead, melts at about 95° C., or 203° F., or less than the boiling point of water.

Solders.—Lead alloyed with tin forms various solders. Fine solder contains 2 parts of tin and 2 of lead; common solder, equal parts of tin and lead; coarse solder contains lead 2 parts, tin 1 part; plumber's solder is the same as the last.

Pewter is composed of 80 parts of lead and 20 parts tin; but to these copper, antimony, or zinc are generally added. Lead alloyed with tin and bismuth forms a variety of alloys that are remarkable for their extraordinarily low melting points.

Silver melts at about 1873° F., or at about a bright red heat. Like gold, it is not attacked by air or moisture—the tarnish which appears on silver ware being caused by gaseous compounds containing sulphur, which are frequently present in the air. A very extraordinary property is possessed by silver of absorbing a considerable number of times its oxygen when highly heated in that gas, or even in common air. This oxygen is not combined with the silver, but is given off at the moment of solidification of the metal—a circumstance which produces the peculiar arborescent appearance common to masses of the pure metal. The presence of a small percentage of copper prevents the absorption of oxygen. According to Lampadius and Depretz, silver gives off vapour at very high temperatures. The presence of a small quantity of arsenical vapours greatly increases the ease with which it is volatilised.

(To be continued.)

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THE DIAMOND FIELDS OF SOUTH AFRICA.

By William Ford.

WHEN a little Dutch girl early in the year 1867, playing near the Orange River, picked up a pretty glittering crystal which was afterwards ascertained to be a diamond, it was not surprising that considerable interest was excited in the event, fraught as it was with important consequences to this part of the world. Many persons were dubious; some openly disputed the fact of its being a real gem; but the question was set at rest by Dr. Atherstone, of Graham's Town, who pronounced it a veritable and genuine brilliant. Others were soon afterwards discovered, which left no doubt of the existence in quantity of these resplendent minerals in South Africa; but it was some time before the general public gave full credence to the assertion. Diamond dealers in England and elsewhere took alarm, as such a discovery would depreciate the value of their stock in hand, and one enterprising firm even sent out an experienced geologist to report upon the question. After traversing the country, he gave a decided negative opinion, and pronounced such a discovery impossible. There was some reason for this decision. The character of the country and the nature of the soil in which they were said to be found were so widely different from those of the diamond region of the Brazils as to readily lead him to an adverse opinion. Nevertheless, the work went on. Diamond seekers flocked to the banks of the Vaal River, and in a few months many thousands of hopeful workers had collected together. The river diggings went on for some time with varied success. Many found great prizes, and as the price of diamonds had not then been materially reduced, large amounts were realised. Hundreds, however, returned luckless. The work here was exceedingly laborious. Pits had to be sunk in drift soil amid enormous boulders of gneiss granite and clay-slate, and the extracted earth had to be carefully washed at the river-side. Some worked for weeks and even months without finding anything, and numbers left the scene discouraged, after expending all their means in their struggle for fortune. It was not long, however, before more fruitful fields were found. People began to look about. The work of prospecting commenced; a remarkable formation was observed some few miles from the river, upon a farm belonging to a Dutch farmer named Du Toit. The surface of the soil here, but very imperfectly covered with short grass and karvo bush, showed strange protruding rocky ridges, more or less of a circular form, the enclosed area being slightly depressed below the level of the surrounding space. This formation has been aptly compared to the outline presented when a tablecloth is spread over a soup-plate. Within the circuit of these magic rings the diamondiferous soil was discovered. This is the true birthplace of the gems. Those found elsewhere outside this boundary have been carried away from their original situation by water-drift. Diggers have discovered the inutility of searching on the outside of the enclosed walls: it is only a waste of time. The soil with which they are mixed differs in nature and colour according to the depth of the excavation. For more than one hundred feet down it consists of a light fawn-coloured friable concrete of lime, mixed with calcareous grit, interspersed with crystals of quartz, garnets, and a black, heavy substance which the miners incorrectly term carbon. When the pits are sunk to a greater depth, the matrix bed differs materially: the celebrated blue soil is reached. This also appears to be of a composite character. It is much harder and more compact. Fragments of blue and black shales and clay-slates appear mixed heterogeneously together. There is no stratification or proper cleavage, but the rock breaks readily under the hammer; it moulders and crumbles away upon being watered and being exposed for a day or two to the sun. No satisfactory theory has yet been advanced to account for the creation, in Nature's vast laboratory, of the valued stones. That they consist of carbon and oxygen is ascertainable by analysis and by their combustion; but how these two gaseous bodies have been forced into combination so as to form these brilliant crystals, is at present only a subject of conjecture. The strange pits in which they present themselves, lined as they are by an indurated rocky structure, would almost lead to the inference that they have, at some geological period, formed a series of mud volcanoes long since extinct and now choked up with mineral matter ejected by the action of fire from the lower strata of the earth. It may therefore not unreasonably be argued that the work of construction of these resplendent gems has taken place deep in the bowels of the earth, under immense pressure, and that by the force of volcanic agency they have been forced up these singular funnels, and thus brought within reach of man's busy hands. The success that attended the seekers at Du Toit's speedily found emulators. Other magic rings were discovered—De Beer's, Bult Fontein, and lastly, the most important of all, New Rush, or Kimberley as it is now called. These all lie within a radius of a mile or two. As the traveller approaches the Diamond Fields from the north he perceives before him a long sloping hill of very moderate elevation tending to the south-west towards the valley of the Vaal which lies at a distance of about twelve miles. At the highest swell of this hill the diamond pits have been sunk. All this part of Africa bears incontestible evidence of the action of water. Deluging torrents of inconceivable force have torn away the face of the country and swept clear to either ocean. This power has evidently pared down and smoothed away the surface of the hill which had given birth to the valued crystals. The diamonds now found in or about the Vaal River are doubtless those which have been swept before the irresistible wave from the eastward, and there deposited in the detritus brought from higher lands of the interior. Lord Carnarvon asserted in the House of Lords that no less than £12,000,000 worth of diamonds have been already unearthed from these mines The beneficial effect upon the whole of South Africa has been magical. When Mr. Froude was amongst us he tried hard to dissuade people from continuing this occupation. He urged that the man who grew a potato was a greater benefactor to his race than one who brought to light a nugget of gold or a diamond that might sparkle in the diadem of a monarch. Singularly perverse, the colonists would not listen to him, but still went on in their search for wealth. Mr. Froude should have saved his breath for the leaders of fashion of the older countries, and for that class he has so suddenly fallen down in blind adoration before, the landed gentry of England, and endeavoured to induce them to forego the use of such superfluous extravagances and luxurious indulgences as gold and diamonds. Always in Africa he preached in vain to men who were getting in one day enough to keep them for a year, who were getting in a year enough to keep them for life. That these workings have been of incalculable benefit to the continent is without doubt. The coincident increase of commerce, construction of railways, and general progress are clearly traceable to the stimulus. It has, however, not been without its drawbacks. Natives from all parts journeyed to the fields for hundreds of miles to earn enough to purchase guns and ammunition, so as to place themselves, in their own opinion, upon an equality with the white ruler. No less than 1,500 Kafirs passed through on their return from the Diamond Fields fully armed with the coveted musket. The possession of arms was the cause of the breaking out of the Kafirs in Natal three years ago. This has also been the cause of the eruption of the tribe of Sececoni upon the burgers of the Transvaal. This will be the cause of the Zulus defying the British power, and with others shake society to its foundations. Kimberley mine is an unique sight. There is nothing like it in the world. It is a vast inverted hive of working bees. Imagine an open elliptical chasm excavated in the earth to the depth of nearly 300 ft., measuring at its longest diameter 600 ft., and at its shortest more than 400, slightly narrowing as it deepens, with stages all round the mouth, forming platforms for raising and discharging the diamond bearing rock, wire-ropes radiating cobweb-like from the stages to the claims down below, up and down which pass the full and empty buckets, with thousands of busy workers above and beneath, amid much noise of Babel tongues and clangour of machinery, an African sun throwing his lustre over all, and some faint notions may be formed of this scene of human enterprise and activity. The original size of the claims allotted to the diggers was a square of thirty feet; it is, however, not every portion of the mine that is equally valuable. Certain parts are exceptionally productive. These claims have been cut up into halves, quarters, and eighths. The subdivisions fetch hundreds of ten thousands of pounds. They are frequently sold by auction, and are transferred from one to another as safely and regularly as a freehold. People work their claims on joint stock shares; some find capital, others labour and superintendence. Twelve months ago a trustworthy man could get twenty shillings a-day for overlooking Kafir workers. Notwithstanding their vigilance, constant robberies took place. The laws against purchasing diamonds from Kafirs are very stringent. The assembled multitude at first lived in tents; subsequently much more substantial dwellings have been substituted. The trade of Kimberley is brisk: shops and stores abound, and it bids fair to become a commercial centre, even if diamond digging should cease. The morning market is a very busy scene indeed. There is not a large fixed population, the greater part being made up of temporary and migratory visitors, whose number increases and diminishes in accordance with the profits of the workings, and ranges from 15,000 to 40,000 persons, exclusive of the blacks. The climate of the locality is one of the healthiest in the world. It is hot in summer, but the air is remarkably pure and invigorating. The most trying period is the winter season, the night frost being intensely felt. The association of so large a number of persons upon such a limited space without hygienic precautions led in the early days to much sickness, particularly among the reckless and intemperate. The Fields may be reached from Cape Town, distant about 666 miles; Port Elizabeth viâ Graham's Town 444, by stage coach or ox waggon. Natal offers the most pleasant and picturesque route, but the means of conveyance are not so rapid as those of the other. The distance from Durban is 510 miles. Five pounds is the usual fee charged for transit by ox waggon from Port to the fields, and the time occupied may be fairly estimated at about five weeks, during which time the passenger has to find his own supplies. Fifteen pounds is the charge by mail cart, which usually delivers its passengers within a week from the day of starting. Provisions may be stated as moderate in cost, with the exception of luxuries, which are high. The congeries of workings, Kimberley, Du Toit's Pan, De Beer's, and Bult Fontein, were primitively called the "dry diggings," in opposition to the water diggings on the banks of the Vaal River. The way of separating the diamonds from the earth with which they are mixed, as was first practised, was by placing the soil upon a table and passing small portions of it in review at a time, using a piece of zinc or tin as a scraper, and with it sweeping the examined earth off by stroke of the hand. In this somewhat careless way many small stones were overlooked, and even several larger ones, that it has now come a regular occupation to re-search this supposed to be exhausted soil. This is called débris working, and forms a profitable employment for the man of very limited means. The earth to be re-examined is placed in small quantities at the upper end of a trough, which slants downwards towards a large vat, or sort of pugmill; down this trough is directed a stream of water, the large fragments of rock and stones being picked out in their descent towards the reservoir, while the dirt, diamonds, garnets, and crystals are swept into the vat. The redundant water now becomes thick with mud, escaped by openings made near its upper edge. In the evening the exciting time arrives: the "washing up" takes place. The water is drained from the reservoir; the gritty sediment collected from the bottom placed in a fine sieve, which together are immersed in a vessel of clear water and gently sifted therein, so as to separate by natural gravity its different contents; the sieve is elevated, the water is thus drained off, and the sieve being dexterously inverted and removed, the diamonds are shown glittering at the top of the mass. In this way the entire product of the day's labour of several hands is collected in a few interesting moments. The blue conglomerate from the deep diggings is treated in much the same way. It is first broken into fragments, spread out in the sun, and watered. This causes it to crumble to pieces. It is then carefully taken to the washing apparatus and sluiced, in exactly the same manner as the débris. As the chance for finding valuable stones is now much more probable—indeed, in the earth from the richest parts of the mine, certain—the "washing up" is done twice a-day. Latterly the workings have been somewhat impeded. The price of diamonds in the European markets has been encouraging. In addition to this, on the day before Christmas of 1876 a slip of 50,000 loads took place on the east side of the mine. This covered in a great number of the claims, and the earth would have to be removed at an estimated cost of £10,000 before they could be worked again. It was also said that other slips impended. Kimberley mine is the smallest, but richest. It is as yet unknown to what depth it extends. Boring has been forbidden. The diamonds of the river diggings are said to be of the purest water. Those of Du Toit's Pan rank next in merit. The workings at Du Toit's are very extensive. The gems of Bult Fontein are small, but fine in quality. Many of the stones found at Kimberley prove delusive. These are the glassy stones. They would seem to have been cooled too suddenly, for when they are exposed to the upper air they splinter of their own accord into fragments. The miners generally look for a rich gathering from beneath the large boulders. It is not uncommon that pieces which match of the same stone are found widely separated. The most usual and perfect form is the octohedron. Twin crystals are sometimes found. Many of the largest stones are beautiful straw-coloured gems. Red and blue stones have been unearthed. Black orange are rarities. Mention is made of a large diamond having been picked up near Lydenberg, and other smaller ones were discovered at Lemburg's Valley, between Bethelem and Harrismith, in the Free State. For some time a prejudice existed against the Cape diamonds. They were said to be inferior to those found elsewhere. The high authority of Professor Tennant ought to set the question at rest. He states that the number and quality of diamonds from the Cape are equal to those from the Brazils, which have chiefly supplied Europe for the last eighty years. About ten per cent. of the Cape diamonds may be classified as of the first quality, fifteen per cent. of the second, twenty per cent. of the third, the remainder, under the name of bort, are employed for cutting diamonds and for the various economic purposes to which this valuable substance is applied by the glazier, the engineer for drilling rocks, the lapidary, and others. Many diamonds contain specks and cavities; these are placed in the hands of skilled workmen who are acquainted with the cleavage, and by careful manipulation they are frequently able to remove these blemishes, and so to obtain portions of the gems of the first quality for making small brilliants, roses, and tables.

THE PREACHER AND HIS CLOCK.

The *Tatler* is answerable for the following anecdote relating to an eminent preacher in London:—

The happy idea struck this worthy ecclesiastic that a large and handsome clock would assist in drawing the attention of the public to the immense building which serves as a place of worship for his followers; while it would also serve the purpose of decoration. He made a note of the leading clockmakers of the city, and then presented himself first to the most enterprising one, numerous advertisements having made him familiar with his name. The reverend gentleman, without disclosing his name, opened the plan of adorning his church with a monumental clock to the illustrious clockmaker, whom we shall call Smith. After some consideration Mr. Smith declared that he would supply a clock which should be one of the wonders of London for the sum of £150. His Reverence then divulged his name; explained to the manufacturer the many benefits he might derive in the shape of publicity from a clock placed in such a position, and asked if that would not make a difference in the price, Mr. Smith was not slow to understand; he saw that those advantages were certainly worthy of consideration, and offered to erect the clock for £75. "Very well," said the preacher, "I will think the matter over and return you an answer."

His next step was to interview Mr. Brown. After giving his name and stating his errand, he informed Brown that Smith had offered to furnish a clock of the style required for £75; but before concluding he wished to be informed of the prices of other manufacturers. Brown, who is also a business man, answered without hesitation that under the circumstances he would make a similar one for £50. Due note was taken of this offer also, and his Reverence begged again to be allowed time for reflection. He then found his way to Jones, another clock manufacturer. The latter, after hearing the offers of his rivals, perceived at once the chance of a permanent advertisement, which would well recoup the outlay. After expressing his great regard for the eminent preacher, Jones declared that he would feel pleased to present him with the clock if he would do him the honour to accept it.

The preacher could not help being touched with the delicacy of this offer, the more so because Mr. Jones did not even belong to his congregation. He was, however, too prudent to close at once, and assured Mr. Jones that he would submit his generous offer to the committee and communicate the answer in due time.

Shortly afterwards our reverend gentleman is knocking at the door of Mr. Robinson, a clockmaker enjoying a universal reputation. He is, of course, informed of the respective offers of Smith, Brown, and Jones. With such examples of generosity before him, how could he do otherwise than emulate them? Expressing the great interest he ever took in the cause of religion, he informed his Reverence that he would not only construct the clock free of charge, but add a cheque of £50, to be disposed of at his convenience. It is useless to add that this offer was at once accepted without any reference to the Committee.

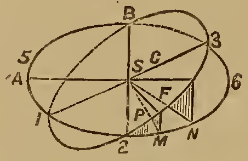
HOROLOGY.

(*Continued from page* 101.)

XXX.—Its Relations to Astronomy.

By G. B. Miller.

We have already reverted to the seven elements of the orbit that are required to be determined if it is necessary to locate a planet in space. The reader may, by means of the following diagrams, get a more comprehensive idea of these elements, and a very slight acquaintance with geometry or geometrical reasoning will enable him to see why they are absolutely requisite. Assume 1, 2, 3, Fig. 1, to be the elliptical orbit of a planet; S, the sun, situated in one of the foci of the ellipse; and C the centre of he major axis. A is the first point of Aries, as that is assumed to be the point of the vernal equinox; 5, 2, 6 represents the plane of the ecliptic. The elements of the orbit are: First, the major axis, 3, 1. Second, the excentricity, C, S. Third, the periodic time, or the earth's revolution around the sun being taken as a unit of time, what is the period in which the observed planet performs its revolution around the same common centre, the direction always being from west to east? Fourth, the longitude of the planet's perihelion, or that point in its orbit nearest the sun; and all the movements of the planets are dated from the longitude of the perihelion, whether for the planet's antecedents or its future positions, thus by an almost direct measurement obtaining the period of revolution. Here are four elements which enable the computer to determine the form of the orbit and the angular velocity of the planet. But it is yet required to find the planet in space at any required moment of time; and, in order to render the analysis complete, that moment may be taken in the past, present, or future, so that the astronomer may know where Saturn was 1,000 years ago, its place now, and its position in its relation to the earth and sun 1,000 years hence. To calculate this problem we must have the angle contained in A, S, 1; the angle 3, 2, 6, which measures the inclination of the orbit to the ecliptic; also the angle A, S, 2, which determines the longitude of the ascending node—as before stated, the measure of the divergence of the orbital from the ecliptical plane giving the latitude.



We have deemed this return to the last chapter desirable, as it is difficult for those unaccustomed to view an abstract mathematical proposition without confusion, and the elucidation will give some idea of the method of reasoning that enabled Le Verrier and Adams to locate an hitherto unrecognised planetary body to within a very few minutes of space.

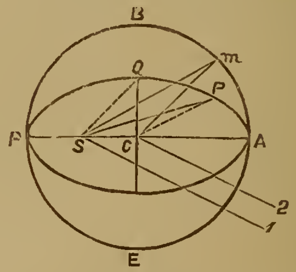
It will be seen, as we progress, that all this is directly connected with horology, for the position of a star in space is of vital importance in transit observations. The observer does not have to make the calculations, and he might merely be called the recorder, for the work is all done in the computing room, and hence the tables are ready for all. Taking up the conclusion of the last article, we would extend our remarks on gravitation, if space allowed, but must content ourselves with merely drawing this conclusion. If it is a fact that our sun, with his train of satellites, is revolving around some primary, we can easily imagine that that primary is again acted on by the same law, and is revolving around some other centre of gravity in space. The deductions could be carried out until the mind becomes completely lost in the mists of the infinite. The only advantage to be gained, therefore, in the consideration, is a conception of the fact that the same law by the force of which a body falls to the earth is the connecting tie throughout all space.

In the progress of astronomy it was found necessary to note the position of the stars by some standard points. We have given one, the latitude; we must then have the other point, and that is the celestial longitude. The reader must bear in mind that this differs in all respects from terrestrial longitude, as will be seen by the following definition:—

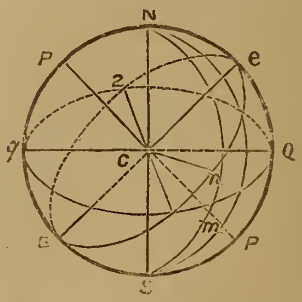
Terrestrial longitude is the angular motion made by any given point on the earth's surface from an assumed standard point. Thus taking Greenwich to be the point of a departure, a star visible in the plane of the polar axis will have an apparant motion westward; and as the earth revolves once in twenty-four hours, and the whole equator contains but 360 degrees, it is evident that the polar plane, which passes through the assumed point, will change its place in relation to the star eastwardly at the rate of 15° each hour of angular motion. The measurement of this angle is taking the longitude, and is of necessity a measurement of time; for, if a star has left the meridianal line of the point of observation, and is observed at another point west of the meridian of observation, the difference of time elapsed gives the number of degrees the earth has revolved during that time.

Celestial longitude is computed from a point in space that has some connection with the earth, and this point is found in the vernal equinox; the angular motion of any celestial body from west to east being estimated from this point. In astronomy, the first point of Aries was the 0° of longitude, but by the different disturbances exerted by other bodies, it has been shown that the vernal equinox is not a quiescent point, and the coincidence of it and the first point of Aries took place some 2,260 years ago.

The vernal equinox is represented by the point 1, in Fig. 2, and the line 1, 2 is the line of the equinoxes.



In Fig. 3, the 1 also denotes the same point as in Fig 2.



The true longitude is then measured by the angle 1, S, P, the mean longitude by 2, C, M; to find the real place we have recourse to the equation of the centre. By inspecting Fig. 3, it will be seen the two longitudes (the true and mean) can coincide in two points only, P and A, the apsides or extremities of the major axis, the true place being at every other point of the orbit, either before or behind, in moving from A through the arc A, P, 2. The true place, P, is behind the mean place, M. Following the whole revolution, it will be seen that in the opposite arc, P would be ahead. Now, half the sum would be the mean place of the bodies at any given time. The true measure of the equation of the centre, then, is the distance C, S, which is also the measure of the excentricity of the orbit when in quadrature. It follows, then, that the place of a planet in its elliptical orbit is obtained by adding or subtracting the equation of the centre to or from the observed mean longitude.

It is necessary that all these qualities should be taken into consideration to get a full and complete understanding of the modes by which time is accurately obtained, as is done by use of the transit or other instruments, in connection with the tables that have been compiled for nearly every important star, planet, or satellite. Yet, not all the difficulties have been mentioned. The correct observer in computing his observations must take into view the distance of the object, its relative fixedness, and the path that its ray of light takes in reaching the observer's eye after leaving the body. Again, we must not neglect the fact that light takes an appreciable time to travel through a given space, and to this fact we must add another, that the earth changes its relative position to an appreciable amount during an observation, however limited in time.

We may add one more difficulty in estimating a position in space. The error in an observation arising from this last cause is designated the aberration of light. It would be useless to speak of getting the longitude by lunar observation were we to leave out the various disturbances incidental to the moon's path, arising from the reaction of the earth on the moon. It will be necessary, then, to treat of light and its laws pertaining to astronomical research, and it may not be uninteresting to define the method by which the distances of the heavenly bodies are determined. In all cases a ray of light is taken as travelling in a straight line, as it would, provided the medium through which it passes was of a uniform density. Suppose an object—say the pole star—is observed : we should be in error were we to assume its true place to be that indicated by the instrument. Our first object must be to ascertain the distance of bodies from the earth and each other. In mathematics it is demonstrable that any triangle may be measured, provided we have one side and any two angles. Thus, if we have a base that is accurately measured, and the contiguous and opposite angles known, we may ascertain the value of all the other parts. Now, the diameter of the earth is well known, having been determined to within a small fraction of a mile, its equatorial radius being 3,962,824 miles, and consequently the whole diameter 7,925,648. This quantity can be used (the radius as a base of a triangle) in taking the angle that the radius of the earth would make, as seen from the body under observation. This angle, so viewed as from the centre of the moon, or any other celestial body, is called parallax, and by it the distance of the earth from the body may be determined. If we conceive two lines to be drawn from the centre of the moon to the centre of the earth and to the eye of an observer respectively, assuming the moon to be just rising or setting, we shall have a right-angle triangle, the base of which is the earth's radius; and as this is a known quantity, and the angle formed by the junction of the two lines at the centre of the moon can be measured, we have the three angles and one side—all that is requisite to get the true value of the other two sides of the triangle, and consequently the distance apart of the two centres. The same may be effected by the combined observations of two persons, if the points of observation are on the same meridian and at a great distance apart. In this the horizontal parallax is not used. The two observers take the zenith distances of the object on the same day, at the time of its passage over the meridian. The hour, minute, and second must be the same, as it would, the meridian being the standard. This was the process by which, from observations taken simultaneously at the Cape of Good Hope and Berlin, the mean horizontal parallax of the moon was found to be 3,459″. From the explanation of the reasoning on which the computation is conducted, it can be calculated by any one at all accustomed to trigonometrical computation. The distance of the moon, as deduced from the observations, is 237,360 miles. The parallax is equal to the radius of the earth, divided by the distance of the moon (thus $\frac{3949585}{237360}$=parallax); it must vary with the distance of the moon from the earth, under the same degree of latitude, thus proving the ellipticity of the moon's orbit.

It will be apparent to any reasoner that an increase of distance would tend to impair the accuracy of an observation, and when the distances become enormous the errors accumulate so as to render the subsequent computations of but little value. For this reason the parallax of the sun could not be obtained with the same correctness as that of the moon, the slightest error in the observation being fatal, from the great distance. The planet Venus, however, affords us the means of getting the distance of the sun. When she arrives at her nodes (that is in the same line that joins the centres of the sun and earth) she must necessarily pass over the disc of the sun, and consequently the transit would be visible to an observer on the earth. If the sun and planet had no parallax, this transit would describe the same line of passage over the sun's disc, and be of the same duration of time to every observer on any part of the earth. But the earth's diameter is a sensible magnitude when viewed from the centre of the sun, and therefore, if two observers at opposite points of longitude observed the transit, the lines described by each would be nearer to or farther from the sun's centre in just the proportional difference of longitude. The sun's diameter being so much greater than that of Venus, the time of the transit will be of shorter duration when the line falls towards the edge of the sun's disc than when it falls near the centre. This difference of time is due to the effects of parallax. The motions of Venus and the sun being known, this eclipse of the sun, for such it is, is computed by the same means that eclipses of the sun by the moon are calculated. The ratio of the sun and moon's distances from the earth at the moment of the transit is known by the theory of their elliptical motion. The ratio of the parallaxes is inversely as their distances; the transit determining the parallax of the sun. In 1769 a transit of Venus was observed at Otaheite by the astronomers attending Captain Cook in his first voyage, the voyage having been projected for the purpose; and it was also observed at Wardhus, in Lapland. The whole time of the transit at Otaheite was about six hours, and that at Wardus differed by eight minutes. This difference gives the sun's parallax at 8″72, but subsequent considerations have reduced it to 8″6, and the distance deduced is now estimated at 95,000,000 miles.

When, however, the object becomes so distant as not to present an appreciable diameter, or, what is the same thing, when the earth's diameter would present but a point if viewed from that object, the two proceding processes of obtaining its parallax fail, and another base is taken, and that is the diameter of the earth's orbit. Great as is the dimensions of this line, it, in its turn, becomes a point when viewed from an object distant 200,000 times greater than the diameter, which is 190,000,000 of miles. One star (fixed we call it) has had its parallax thus taken, and the angle under which the diameter of the earth's orbit would be seen amounts to only 1″, and this, the nearest fixed star, is more than 200,000 times the distance of the sun from the earth, and the star 61 Cygni had been known to have the largest annual translation in space, and accordingly it was assumed to be the nearest fixed body. Arago and Mathieu tried to find its annual parallax. M. Bessel found that the angle having 190,000,000 of miles as a base was but 0,33″. Thus *α* Centauri is still the nearest, for 61 Cygni must be 592,000,200 times the distance of the sun from the earth. This distance may be more vividly realised when we state that the star is seen in the spot where it was nine years and three months before the observation, owing to the fact that a ray of light travelling at the rate of 190,000 miles per second would take that time to reach the eye.

The motion of this star is annually 5″ in space. At that distance 1″ of space would require a base of 24,000,000,000,000 of miles; then 5″ will give us 120,000,000,000,000 of miles. Arago says, "And yet we call this a fixed star!" The diameter of the earth's orbit is too limited to become a base of mensuration, and we are forced to measure the distance of other stars on the assumption of the velocity of light. This may be, in course of time, effected in the instance of what are called double stars, by finding the difference between the place of the satellite star at opposite points of its orbit; by finding this we may have the diameter of the orbit, and consequently the angle at the centre of the earth which it subtends.

(*To be continued.*)

NICKEL PLATING SMALL ARTICLES.

Most processes hitherto employed for nickel plating very small objects have in turn proved unsuccessful. Those of our readers who have to deal with this branch of industry will no doubt be glad to hear that Dr. Kayser, an eminent chemist of Nuremberg, has succeeded in discovering a process which is not only easy of manipulation, but secures also highly satisfactory results. For the particulars of this method we are indebted to a German scientific review (*Technische Blätter*).

One part of copper and five parts of tin (Australian preferable) are melted together. This alloy is then pulverised, as usual, but not too fine, and made into a paste by mixing it with water and cream of tartar; the latter as free as possible from lime. One part of calcined oxide of nickel is then added to every 200 parts of pulverised alloy. The articles are then immersed in it, and after boiling for a short time they will be perfectly coated on withdrawal. A little oxide of nickel must be added from time to time. Copper and pewter articles can be plated in this manner without previous preparation, but those of iron must be coppered first.

By the addition of a small quantity of carbonate of nickel to the above bath, an ordinary white bath is produced and by boiling a richer and deeper colour is obtained, varying from that of platinum to a bluish-black, according to the quantity of nickel salt added.

The following lines were written by Prior (1644-1721):—

So, if unprejudic'd you scan
The goings of this clockwork man,
You find a hundred movements made
By fine devices in his head;
But 'tis the stomach's solid stroke
That tells this being what's o'clock.

At Hoddam, Dumfriesshire, is the following epitaph:—

Here lyes a man who all his mortal life
Past mending clocks, but could not mend hys wyfe.
The larum of his bell was ne'er sae shrill
As was her tongue, aye clacking like a mill.
But now he's gane—oh! whither nane can tell—
I hope beyond the sound o' Mally's bell.

Dafydd ap Gwvilym, a famous Welsh Bard, living about 1340, thus abuses a clock for disturbing him in a delicious dream:—"Confusion to the black-faced clock by the side of the bank that awoke me! May its head, its tongue, its pair of ropes, and its wheels moulder; likewise its weights of dullard balls, its orifices, its hammer, its ducks' quacking as if anticipating day, and its ever restless works. This turbulent clock clacks ridiculous sounds, like a drunken cobbler—a cobbler, too, in appearance. Cunning and falseblind gut! The yelping of a dog in a pan echoed! The ceaseless chatter of a cloister? A gloomy mill grinding away the night!"

GOLD WATCH WHEELS.

The employment of gold wheels in watches has for some time been the subject of controversy among the trade; and, as is generally the case, the opinions of different authorities are greatly at variance. Some advocate the use of gold wheels as the most satisfactory, while others abandon them altogether as useless. It will, therefore, be interesting to know what two well-known Swiss horologists have to say on the subject.

M. Lossier, in a letter to the *Journal Suisse d'Horlogerie*, writes:—

"The divergence of opinion among horologists as to the employment of gold wheels is simply in consequence of the different qualities of gold used by manufacturers. The alloy best suited for this purpose is the 14 carat gold, which is hard, elastic, cuts well, and resists wear admirably. It is, however, necessary that the gold should be well fused and secured from the oxygen of the air. The latter forms an oxide with the copper contained in the alloy, which possesses two dangerous properties. It wears nearly as much as red polish, and combines itself with the 14 carat gold to the extent of 5 per cent. No wonder that wheels made of a metal which contains 5 per cent of a body analogous to red polish should wear out the pinions. To counteract this defect the gold should be melted with great care at a very low temperature, and covered with coal or sawdust up to the moment of flowing.

Another method for obtaining the gold exempt from oxide of copper is to add a few thousandths of zinc the moment before casting. This operation requires some practice, because if the gold runs too soon it will be full of beads, and if too late the copper will again have time to oxidize. It must be done just at the proper moment, and this is rather difficult. Wheels of 14 carat gold, thus fused, wear the pinions less than brass wheels, and are altogether preferable to the latter."

Mons. Huguenin says:—

"The alloy generally used for the manufacture of gold wheels left so much to be desired, that it is not surprising if a good many watchmakers have abandoned its use. This metal, which had no fixed standard, was short under the file; the cutting file rather tore it out than cut it; it was often flawy and brittle; sometimes containing grains of an excessively hard substance, causing a rapid wearing of the pinions. The most frequent injuries which have come under my notice in inferior watches with gold wheels is the breakage of the centre wheel, occasioned by that of the spring motor. Cases where the pinions have been worn are purely accidental, and I have met with but few of them. In cylinder watches where the centre wheel (made of brass) catches the pinion of the scape wheel near the pivot, I have observed numerous cases of wear at the staffs of the pinions; while those of the small centre wheels had remained intact. The cause of it is that the catching, generally effected by a pinion with six staffs (not always of proper thickness), is more or less defective, and a friction of the teeth of the wheel against the staffs occurs, it being in contact with them at very short intervals.

"This circumstance is aggravated by the fact that oil put on the pivot, often in too great quantities, penetrates easily into the wheelwork, and combined with the dust forms a slime which acquires the causticity of common red polish. Gold wheels are, therefore, not the only ones which cause the pinions to wear.

"I may add that the 14 carat gold employed for wheels of superior movements leaves little to wish for. Its rose colour is superb; it can be forged and worked as well as the best brass; the teeth come out very neat, and the colour of the polished wheels does not change sensibly. The only drawback is that these wheels are more pliable than those made of well hardened brass. The wearing of pinions well polished and of a suitable hardness is, however, not to be feared. I have inspected watches with gold wheels after several years' use, and the pinions were in such perfect condition that the place where the wheel catches could hardly be recognised."

CURIOSITIES OF CLOCKS AND WATCHES.

(Continued from page 103.)

At Waterton Hall is the clock which Sir Thomas More, who was beheaded in 1535, used in his study. A deeply interesting picture from Holbein's design, although not from his hand, and now belonging to Mr. Charles Winn, of Yorkshire, represents the family of Sir Thomas in his house at Chelsea, of which Erasmus has left such a charming description. Members of his family are grouped upon the rushes in the pleasant gallery, with its traverse or cross room, and over the Chancellor's head hangs his famous clock, which still keeps time.

At Hampton Court Palace, over the gateway in the second quadrangle of that portion of the building which was erected by Cardinal Wolsey, facing the east, were the dial and works of an old astronomical clock, which had engraven on it the initials of the maker, N. O., and the date of its construction, 1540. This clock, when entire, showed the twelve signs of the zodiac, with the rising and setting of the sun, the revolutions of the planets, the various phases of the moon, and other things. It is said to have been one of the first of this kind fabricated in England, and the oldest untouched clock in this country that went tolerably well. It appears that in 1575 a payment was made "to George Gaver, serjeante painter, for painting the great dial at Hampton Court, containing the howres of the day and night, the course of the sonne and mone, the xij signes, with the characters of vij planetes, environed into a circle, the sea, shippes, and territories; and on the other side certian badges of the croune, all wrought in oil colours, as vermilion, &c., and gilded with fine goulde; for clensinge the sconde diall, contg. the howers of the daie, half-howers, and quarters, and divers places, of her mat^{s}, trio of name, and sondrie her mat^{s}, badges, wrought likewise in oyle colours and guilded with fine goulde."

A description of Hampton Court in 1649 tells us that in the clock-case upon the Great Hall there is one large bell "and a clock under it, very useful for the whole house, having a fair dial or finger upon the end of the said Great Hall, facing into the Great Court." This clock was repaired by Lang Bradley, of Fenchurch Street, in 1711. Under date 1742 we read, in reference to Hampton Court, that "over the portal of the second quadrangle is a beautiful astronomical clock, the workmanship and contrivance of the late celebrated Tompion, on which are curiously represented the rising and setting of the sun, his gradual progression through the twelve signs of the zodiac, the various phases of the moon, and other such emblamatical amusements as justly make it the object of universal admiration." This statement is assumed to be incorrect, so far as it relates to Tompion, although Grose, in his "Antiquities," makes the same statement as to the constructor. It seems that the clock was again repaired and altered between the years 1760 and 1800. The present clock was made by Vulliamy, and was brought from the late Buckingham Palace, and put up here in 1835.

In the bedroom of William III., at Hampton Court Palace, is a clock which stands at the head of the bed, and was made by Daniel Quare. It is in shape like the old tall eight-day clocks, and it is decorated at the top with gilt figures. It goes twelve months without requiring winding up.

In the *Times*, February, 1827, an advertisement appeared for the "sale of a valuable and curious clock for £20, to go for twelve months." It stated that only three of these rare clocks were ever made, namely, one at Hampton Court, one in a nobleman's family, and other at the advertiser's.

Babbage, in his "Economy of Manufactures," 1835, tells us that the extending the time of the action of forces "is one of the most common and most useful of the employments of machinery. The half-minute which we daily devote to the winding up of our watches is an exertion of labour almost insensible, yet by the aid of a few wheels its effect is spread over the whole twenty-four hours. In our clocks this extension of the time of action of the original force impressed is carried still further; the better kind usually require winding-up once in eight days, and some are occasionally made to continue in action during a month, and even a year." Early in the last century, at the Palazzo di Colonna at Rome, was a portable clock which was wound up only once a year, and showed the hour of the day, the month, the year, and other things. The Marquis of Bute had at Luton Park, Bedford, a clock which was contrived to go for one hundred years. In Sir John Moore's account of his "large sphere-going clockwork," we read it made a revolution of once in seventeen thousand one hundred years, by means of six wheels and five pinions for the sun's apogeum.

At a meeting of the Cambridge Antiquarian Society, held on November 29th, 1847, Professor Willis made some remarks on a clock which had been found in an old house near Royston, but which was then in the museum of the Society, for which it had been purchased by the private subscriptions of a few of the members. He considered it to have been made in the time of Henry VIII., but not in England. The works, having an escapement and pendulum, could not have been of that date, since a pendulum was first applied to clocks in the latter half of the seventeenth century. The case was in the form of a tower, with corner pinnacles. The parapet of the sides was ornamented with what is termed flamboyant tracery, formed of pierced-work. On each side of the face was a pile of buttresses supporting an ogee arch enclosing the clock-face, the space between which and the arch was filled up by a mass of most beautiful stumped tracery. As stumped tracery was not used in England or France, the Professor supposed the clock was made in Germany, probably at Nuremberg.

In the year 1544 the Corporation of Master Clockmakers of Paris obtained from Francis I. a statute in their favour, forbidding any one who was not an admitted master to make clocks, watches, or alarums, large or small.

In the accounts of the Chamberlain of Norwich, among charges for the celebration of the exequies of Henry VIII., in 1547, a payment appears "to the Clarks of Cryste church, for ryngyng the clocher bells." The belfry, or bell-house, was sometimes called the "clochier" and the "clokerre."

In the churchwarden's accounts of St. Margaret's, Westminster, under date 1548, is the following item: "Also paid to the said John Ivery for the keeping of the v a clock and viii a clock, for half a yere and half a quarter ended at the same feast, 16s. 8d."

We find in an account of the "Ordenarye Paymentes in Sep. 3, Edw. VI," 1550, made on behalf of the King, the following: "Item to Allaine Bawdyson, clockemaker, by vertue of the Ks. warrant under his prevye signet, dated at the Palaice of Westmr. the thurde daye of Aprill, Ao. Regis Edwardi sexti iijcio, the wages or fee of viij by daye which Sebastian Lysney, cloke-maker, late enjoyed, &c., Xij^{li}. iiij^{s}."

In the "Calendar of State Papers," temp. Edward VI., we find, under date December 25th, 1551, a letter written at Paris by Sir William Pickering to Sir William Cecil, in which the writer refers to a book entitled "L'Horloge de Princes."

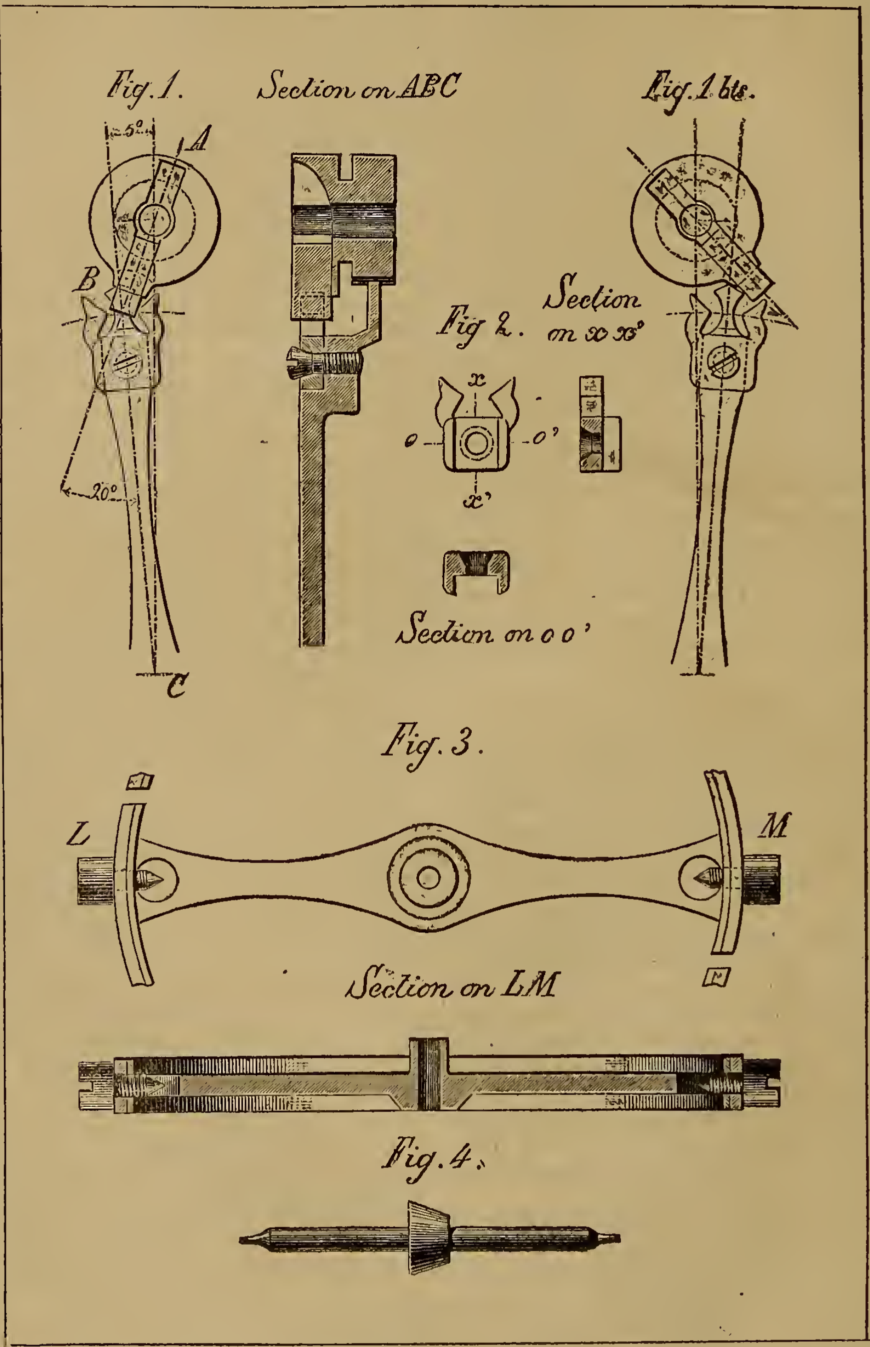
Strype, in his "Life of Sir John Cheke," Secretary of State in the time of Edward VI., and who died in 1557, mentions that among other presents bestowed on him by the King was his own clock, which after his death came into the possession of Dr. Edwin Sandys, Bishop of Worcester, afterwards Archbishop of York, and father of George Sandys, the poet, who in 1563 gave it as a new year's gift to Sir William Cecil, the Secretary, afterwards Lord Burghley.

Strype, writing in 1705 says: "And among the rest of these greater gifts of the King, I must not forget the mention of one smaller, a token yet of the love he had for him; and that was of his own clock, by which 'tis probable his Majesty with his schoolmaster had studied many an hour."

(To be continued.)

THE "CHAMPOD" ESCAPEMENT.

Early in 1875 there was submitted to the Horological section of the Industrial and Commercial Department of the Society of Arts of Geneva a large model of a lever escapement, constructed by M. Denker, a German watchmaker. This escapement had a new and very advantageous feature, whereby the friction arising in the transmission of the impulse from the pallets to the balance was materially reduced. This improvement had its origin in the fact that M. Denker, in order to diminish the friction resulting from the action of the different forms of ruby-pins ordinarily used in the notch of the lever, made a lever with a notch of a dove-tail shape; that is to say, having its sides widening back towards the centre of motion of the pallets. This allowed the impulse to be given by the two sharp corners of the notch acting on the sides of a rectangular ruby-pin fixed vertically. Besides, the whole of the notch in the lever was faced with gold.



In order to appreciate the advantages of an escapement of this construction, it is necessary to consider the action of the ordinary steel lever, and to compare it with the gold one above described. The accidents which happen to escapements with steel levers and ruby-pins of the various shapes—such as oval, half-round, or triangular, generally arise from the defective construction of these pins. It is very difficult to obtain them so well made, both as regards shape and finish, that they do not injure the sides of the notch in course of time, and so much so that the pallets are no longer serviceable. This more particularly happens when the ruby-pin has a roughness on one of its sides, or when the oil, which must be used with steel and ruby working together, has dried up. Even bad oil, such as is often used by those who repair watches, may lead to mischief of this kind.

Escapements with a gold fork, on the contrary, require no oil to be applied to the ruby-pin; hence neither the lever nor the faces of the ruby-pin on which the angles of the notch act are subject to wear in action. Besides, it is much more easy to get these flat surfaces well made, than the angles of the ordinary pins. The friction, therefore, of the corner of the fork against the faces of the rectangular pin is much less than with an angular pin acting against the flat surface of a rectangular notch.

These advantages being proved, some escapements of this kind were made in Geneva, and the manufacturers had the satisfaction of obtaining excellent results therefrom. But a very great obstacle presented itself, and which was, how to line with gold the inside of the notch of a lever of the small size used in a watch. What could be done on a large scale was impossible on such a small one. In order to overcome the difficulty, levers were made entirely of gold. This was a step in the right direction; but this metal, although tolerably hard, if properly alloyed, was not as strong as steel, and if levers made of gold get into the hands of an unskilful workman, he might put them slightly out of shape, and so destroy entirely an originally well constructed escapement. Another inconvenience in the use of gold levers arises from the weight of the metal, which is much heavier than steel.

It was, therefore, necessary to devise some plan that would not leave this escapement liable to accidents, which might deprive it of its undoubted value. A method of fixing a gold fork on steel levers in such a way as to possess the same solidity as if the parts were made of one piece of steel, has been sought for, and it will be shown hereafter that this has been done most successfully, and that the inconvenience of making the levers entirely of gold has been obviated, while at the same time the advantages of a gold lever are preserved. With a view to give to this escapement all the solidity possible, and to avoid uncertainty in its action, the two rollers have been made of a single piece of steel. They are separated one from each other by a little groove. It was necessary that these rollers should be fixed to each other, because the adjustment of the ruby-pin and of the notch in the lever has to be made to a great nicety, and consequently the hollow in the small roller for the safety-pin or guard has to be very small, and its position, as regards the ruby-pin, to be mathematically correct. If the two rollers were made separately, one of them might get displaced, and the hollow would then no longer be in accord with the ruby-pin. This cannot happen when the rollers are made of one piece, for it is evident that the position of one cannot be altered without the other moving in unison with it. Instead of the rectangular ruby-pin being fixed vertically, as M. Denker had it, the same rectangular pin is held horizontally. The action is precisely the same, the only difference being that the ruby is more secure. Less height is required, and the impulse given to the balance is more direct, and this without increasing the lift or affecting the unlocking. The setting of the escapement is equally avoided. This construction allows the action of the fork and roller and of the safety-pin or guard to be distinctly seen.

These rollers are fitted on a straight round arbor, so that the balance-staff is very easily made. To obtain the same simplicity in the fitting of the balance, the form employed by M. A. Lange, of Glashütte (Saxony), is used. It differs from the ordinary one inasmuch as the balance has a pipe left in the centre of the arm, the inside of which serves as a fitting for the balance-staff, and the outside for the pendulum spring collet. The balance-staff is made with a collar near the middle, against the under side of which the rollers fit, while the balance rests upon the upper one. In case of accident it is an easy task for a workman to replace the balance-staff without altering in the least the rate of the watch; for the rollers are always in adjustment, and the position of the pendulum-spring collet will not have been changed. The balance being held simply by friction, will not have to be riveted, a process by which they are frequently put out of shape and injured.

Description of the Drawings.

Fig. 1 is a plan of the improved construction of the steel lever with the gold fork-piece. The pallets are supposed to be on the point of unlocking. BC is the lever arm made of steel, the safety-pin B being simply the pointed end of it. Its adjustment in the small roller is permanent.

In the section annexed to Fig. 1 it will be seen that the lever arm BC is stepped down and has a tapped hole in it. The object of this step is to form a shoulder for the back of the gold fork to bear against, and the hole receives the screw that fastens it.

Fig. 2 represents the gold fork-piece seen from its under side. In the longitudinal section XX', and in the transverse section OO', Fig. 2, the groove to receive the end of the lever arm is shown, and also the countersink for the fastening screw.

Fig. 3 shows a plan and section of the balance. The proportions of the pipe for the fittings of the balance-staff and pendulum spring-collet are shown, as well as the boss under the arm of the balance. The collar on the balance-staff is shown in the Fig. 4 representing it; on this collar the balance bears.

The "Champod" Escapement is the property of the well-known firm F. M. Badollet and Co., of Geneva, whose sole agents for England are Messrs. Huguenin, Son, and Hall, 50, Greek Street, Soho Square, London.

A new Club for the Diamond Trade.—A club styled "The Diamond Merchants' Club" has been formed during the past few weeks, with its head-quarters at 19, High Holborn, and from the number of influential members who have already enrolled their names, the undertaking promises to be highly successful. The present officers are Messrs. A. Oran, President; S. Goldman, Vice-President; J. Lindo, Treasurer; and M. Davis, Hon. Secretary. We learn that the club numbers already seventy members. The rooms are comfortable, and every endeavour seems to be made to make the undertaking what a trade club should be. We predict that its formation will be of considerable advantage to both vendor and purchaser as well as to the trade in general, and country dealers especially will find it of great service, and we trust to be able to chronicle the continued success of the undertaking. Persons wishing to join the club as regular or as country members may obtain all information by addressing the Secretary at above address.

PRACTICAL INFORMATION FOR THE TRADE.

How to colour Gold as in Etruscan Jewellery.—2½ oz. crocus, 2oz. yellow ocre, 1½oz. verdigris, 1½oz. copperas, ½oz. white vitriol, ¼oz. borax. All to be reduced to impalpable powder in a mortar and mixed intimately with 5oz. yellow beeswax, or 20dwts. saltpetre, 20dwts. common salt, 2½dwt. copperas, 2½dwts. white vitriol, 2½dwts. alum. The ingredients to be put in an old crucible and set over the fire, and the articles to be coloured boiled in it until on trial they are found to have acquired the desired colour. The beautiful satin finish is given to the class of goods called Roman gold, by carefully scratching the dead gold surface with a scratch brush made from spun glass.—*Annales de Chimie et de Physique.*

To Clean Tarnished Brass.—Dissolve cyanide of potassium in water, and give the article an instantaneous dip; wash with clean water and then with alcohol. If the article remains in the bath too long, the high polished surface becomes deadened and loses its gloss. Chronometer balances are thus instantaneously cleaned. They may be dipped in the bath just as they are, without removing the hair-spring, and if carefully washed and dried off by alcohol no danger need be apprehended. The plates and wheels of French clocks and musical boxes are quickly done in the same way; in fact, any tarnished brass work.—*Industrie Blätter.*

Drilling Tempered Steel.—Make the drill oval instead of the usual form, and temper it as hard as possible without burning. Touch the surface of the metal to be acted on with a little diluted nitric acid, so as to render it slightly rough. Moisten the drill from time to time with essence of turpentine instead of oil (some workmen use kerosene or good rectified petroleum in which camphor has been dissolved). When the drill will not catch any more, clean the hole at the bottom with the turpentine or kerosene with addition of a little acid and continue the operation. This method is a little complicated, but it is the only safe way for drilling steel which is but slightly hardened.—*Révue Chronométrique.*

Black Finish for Brass.—Make a strong solution of nitrate of silver in one dish, and nitrate of copper in another. Mix the two together and plunge the brass into it. Now heat the brass until the required degree of dead blackness is obtained. This is the method used by French instrument makers to produce the beautiful dead black colour so much admired in optical instruments.

Cement upon Iron or Stone.—A cement made of glycerine and litharge hardens rapidly, and makes a durable cement upon iron or stone. It is insoluble, and is not attacked by acids.

To Hard Solder Jewellery without changing the Colour.—One ounce borax (to be calcined before mixing), one and a half ounce yellow ochre, half an ounce aqua ammonia, water to form into a thin paste, apply with a small brush. Be careful not to have any of the paste where the solder is to go. After mending, soak in cold acid pickle.

To Soften Steel Without Injury to the Polish.—Boil the article for ten or fifteen minutes in linseed or sweet oil, taking care to have it covered with oil while boiling. Large articles take, however, longer.

To make Holes in Glass.—Spread on thinly some borax, after warming the glass. Remove the wax where you wish the hole to be made; with a piece of iron wire put on the spot a drop or two of fluoric acid, and it will eat through the glass. Should it not be sufficient, make a second or third application of the acid. After the acid has eaten quite through, it may be enlarged or shaped with a file dipped in oil of turpentine while using. To polish, use copper-wire, with rotten stone and oil.

Common Brass Clocks may be cleaned by immersing in boiling water. Rough as this treatment appears, it works well whenever they stop from dust or thickening of oil upon the pivots. Boil in rain water, and dry in a warm stove.

ON THE ARTIFICIAL COLOURING OF AGATES, &c.

It may be a question whether, if by imitating the processes of nature, we produce a certain result, our so proceeding is to be styled as a species of deception, or whether it is to rank as a justifiable result of acquired and practical knowledge. We are not about to enter into the moral or philosophical consideration of this subject: our object in this article is simply to point out certain discoveries and improvements which from time to time have been known and practised in this branch of the jeweller's trade. One only remark we will venture to make, and that is, if by any scientific process the manufacturer is enabled to utilise a material which, on account of any defect or deficiency, is unable to be employed as it would have been if in a perfect condition, he is no more to be condemned than the horticulturist, whose efforts are constantly engaged in adding new beauties to the flower, or more useful properties to the fruit or vegetable. Let things only be known by their right names, and let no purchaser be deceived in what he purchases, and then who shall gainsay the artist's improvements? There is one species of opaque gems which was once highly prized; and although the caprice of Fashion has now cast it into the shade, there is no telling but that the same caprice may again bring them into more general use. We mean the onyx and the agate; and, confining ourselves entirely to the purposes of this paper, we proceed to mention some of the methods employed in colouring them. From the earliest ages this practice has been pursued. The moderns, of course, have improved the methods; thus we find that at Oberstein, in Bavaria, at one time the chief seat of the agate production, when Oriental stones became scarce from failure of supply, a method was discovered of altering and improving the appearance of these minerals so as to make them convertible into onyxes and camelians, similar to those imported from India. Dr. Billing, to whose useful and elegantly illustrated work we are much indebted, after chemically describing the natural formation of onyxes, of orystallised or crystalline quartz, of which the first layers are white and impenetrable to water or other liquids, while the other layers are amorphous, porous, and permeable by liquids, shows how, consequently, they are sometimes found coloured by natural processes, and how, by studying the cause of these varied tints, art can be able to imitate them. "Rock crystals," he observes, "are sometimes apparently stained; but this is a deception from which we would guard our readers. It is effected by making them red hot, and then plunging them into water tinged by cochineal or indigo, which fills them with cracks, into which the red or blue liquid penetrates, causing them to appear coloured. But it will be seen, on close inspection, that the *substance* of the crystal remains perfectly colourless between the cracks. On the contrary, amorphous grey chalcedony, when it remains some time in the water of springs or streams containing iron, imbibes the fluid and becomes impregnated with the oxide of iron, which turns yellow, orange, or brown when exposed to the air or sunlight—in fact, what might be termed 'ironmoulded.' In this way, besides those stones formed originally with an admixture of iron in them, stones called sards were produced."

The East Indians burn *brown* stones of this kind to make *carnelian*, as by the heat the brown oxide of iron in the stone deposited from the water is changed into a bright red. The Germans make carnelian in the same way, by heating *brown Brazilian* stones; and according to the quantity of iron contained, and the degree of translucency of the stone, the carnelian produced is of a paler or deeper hue; when very translucent, and at the same time dark red, like a Morella cherry, it also is called sard. Other stones also are improved in appearance by being heated, and by other processes, which we shall describe, the heat being generally the active agent in eliminating the metals contained in them.

Assuming, as we do, that all our readers will only represent a gem such as it is, perhaps others may not be so scrupulous. We would therefore suggest that when they themselves become purchasers, it may be possible to discover the real nature of the mineral in question by a simple fracture, when, no doubt, the plane of the fractured part would present an appearance showing to the practised eye some difference from that which would be perceived under similar circumstances from the genuine article. Previous to making large purchases the microscope, or spectroscope would also be of service.

No doubt nitrous acid at a moderate heat, or nitrous acid gas, would detect any artificial stains from natural colour. When agates were in more general request, both the colour and the external appearance were attempted to be improved by artificial and mechanical means, chiefly (as we shall further detail) by the use of metallic solutions or by boiling in oil of vitriol. The colour was often improved by giving the stone, before it was pulished, several strokes in succession, the small fissures so produced displaying an iridescence, or some other phenomenon, if held to the light. In some cases black-and-white agates were produced, in order to sell them in the place of real onyx. Indeed, it is said that some lapidaries even now boil certain varieties in oil of vitriol, which changes the colour of some very soon to black, and renders others clear or still paler. If desirous to employ this method, care should be taken to select only polished agates for this purpose; the cause appears to lie in the oil absorbed by them during the operation of polishing. And it is on this account that agates are by some first boiled in oil before so doing in the oil of vitriol itself.

The history of agates having been previously related in this journal, we do not here refer to it, excepting to mention that, under the general heading of the term, mineralogists and lapidaries have included the names of carnelian, chalcedony, onyx, sardonyx, sard, Mocha-stone,* blood-stone, chrysoprase, and plasma, all of which are so closely allied to agate that they may to some extent be classified under the same head.

Reverting to our subject, we will observe that other stones are also capable of being improved in appearance by being heated—such as the fluor-spar, topazes, and cairngorm; probably also the turquoise is occasionally so manipulated, and we are not sure if a similar effect might not be produced with more precious gems, although the experiment might be too costly to be attempted.

Chemistry teaches the two elements available for this colouring process—heat and acid, sometimes both conjointly. For instance, to form carnelian, the grey or colourless chalcedony is first steeped in a solution of iron and then heated to turn it red. In this instance, as Dr. Billing observes, "chemistry enables the operator to introduce as much iron into the stone in a few days or weeks as would have been effected in the lapse of ages in the natural way, by the small quantity of iron which exists in rivers or common land-springs."

Let it not be supposed, however, that this *cunning art* is only of modern date. *Inter alia*, we find that Pliny mentions that all gems are brightened by boiling them in honey (especially Corsican, from its acridity), while they are injured by all other acids. Theophrastus also, who has written on precious stones, speaks in his treatise of the various influences, notably fire, to which all earthy minerals are subjected. The Chinese *manufacture* monster agates, exhibiting the loveliest colours very fancifully disposed, by staining slabs of alabaster, by some process of their own; and these fictitious *lusus naturæ* are often seen in this country, treasured up as wonderful curiosities in mineralogy, and of almost fabulous value!

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* Mocha-stone is so called as having been supposed to come from Mocha in Arabia. This is incorrect. "Mocha" is Anglo-Saxon for "moss," and so moss-agate is the proper name of the stone.

But far more wonderful was the invention of the Florentine anatomist (the secret died with him) of pertrifying human viscera into real agates. "In the Hospital of Sancto Spirito," says the Rev. C. W. King, "may still be inspected by the incredulous, a table top made up of hearts, lungs, livers, &c., thus 'agatised' into one large slab—meet board for a banquet of vampires."

Compiling further from the talented work of Dr. Billing, we find that in the production of carnelions, before alluded to, the preparation of iron employed for staining is a solution of the *pernitrate*, which may be made by dissolving two ounces of iron wire in a pint of a mixture of pure nitric acid and water, in the proportion of one of acid to three of water. The workmen make it in a rough way, by putting a handful of old nails into half a pint of "single aquafortis,"* mixed with a pint of water. In fact, he continues, the process requires little accuracy, for the stones take the colour, not so much in proportion to the strength of the solution, as to their own porosity; those that are most translucent (as approaching to crystalline and closer grained) require the longest time—from 5 to 20 days, or more; and some that are very transparent admit no colouring matter at all, whereas stones that are very porous and nearly opaque become like jasper when heated. But the operation is not yet completed, as the stones now contain merely the clear solution of pernitrate of iron; this, however, is decomposed by the application of heat, and the red peroxide is precipitated within the stone, which thereby becomes coloured red. A few minutes suffice for this. Place the stone on a hot iron plate, when the charge changes places visibly; care must however, be taken, as there is some risk of cracking the stone, by doing it too suddenly. The workmen use an oven, or iron vessel, the heat being gradually increased for some days, by which the stones are thoroughly dried. When the heat is raised sufficiently to blacken or char a piece of wood or paper, the stones will turn red; a heat much beyond this would spoil the stones or calcine them. The Indians, when they heat the natural brown stones to make them into red carnelians, enclose them in a mass of clay mixed with camel's or cow's dung before they put them into the fire, to prevent their getting red hot. A crucible with sand answers the same purpose.

The *brown* Brazilian chalcedony, like the East Indian, is reddened by merely heating in the oven. When a *fine* carnelian is cut, and shaped ready for a seal, no person can distinguish whether it be East Indian, Brazilian, or from Oberstein, because each is chalcedony, coloured by peroxide of iron; though some flatter themselves they can tell the difference.

Oberstein, alluded to in the last paragraph, was at one time the chief emporium for the production of agates. As late as 1860 it had as many as twenty mills employed in various parts of the manufacture; although it has of late found a powerful rival in Paris. It was there that the greater part of the natural stone was found; but as this supply became exhausted, it was found necessary to import chalcedony from Brazil, and various methods, such as we describe, have been employed to produce many of those stones now known as agates or onyx, carnelian, and other varieties. Indeed, it has been asserted that the chalcedony can be coloured so as to imitate the turquoise; but the process is not divulged. Perhaps it might be effected by immersing it in a solution of copper, which is the colouring matter of the turquoise itself.

This being intended as practical information for those who may wish to employ it, we purposely enlarge our remarks, the gist of which must be evident, and the principles of the various combinations should be clearly conceived by any one wishing to benefit by them. Another authority cites: "It is well known that sulphuric acid chars or burns black all organic substances, animal or vegetable; such as wood, skin, or any material containing carbon. Now oil and sugar contain carbon. If the chalcedony be steeped in oil or sugar for some time, it penetrates through the pores; after which the stone is boiled in sulphuric acid, which penetrates also, and turns the oil or sugar to a light or dark brown or black, according to the quantity that has been imbibed, which, as before noticed, is in proportion to the porosity of the stone."

The Orientals were acquainted with the art of staining the onyx before the Christian era. They had neither sugar nor sulphuric acid, but they had honey, and they had oil; and though they had no sulphuric acid, they had fire to burn the sugar and oil within the stones; but fire was more likely to crack them than would the acid, as may be seen in many of the Oriental beads.

Although the basis of every change is in most instances the same, yet as there are so many minutiæ connected with the production of the various tints, we purpose supplementing this article with various notes of intelligence on this and congenial subjects for the benefit of those chiefly interested in the trade, whether as lapidaries, jewellers, or gem-engravers.

PAINTING THE HOURS ON METAL DIALS.

Our Swiss contemporary gives the following directions for preparing and applying the black colour which is used for the above process:—

The principal ingredient is soot, which is obtaind by holding a clean copper or sheet metal plate over the flame of an oil or petroleum lamp (a glowing tool serves the purpose very well). As soon as a sufficient deposit is produced it is collected in a piece of glass, care being taken not to mix any foreign substance with it. A few drops of essence of lavender are then poured on the soot and the mixture pounded with a spatula. This done, just sufficient copal varnish is added to give the composition a proper thickness, so as to prevent it spreading when applied. The varnish thus prepared is put on by means of a very fine brush. To secure brilliancy the dial is dried at a slow heat, by passing it lightly over a spirit flame, the reverse side of the dial being, of course, the only part exposed to the flame. This composition must be made in quantities large enough for present use only, as it dries very rapidly and cannot be utilised afterwards.

To secure good results his process requires some experience, which can only be obtained by careful experiments. The painting especially requires a certain aptitude and lightness of hand, which may, however, soon be atained by strict attention.

INTERESTING CALCULATIONS RELATING TO WATCHES.

The balance of a watch beats

5	times	per	second
300	,,	,,	minute
18,000	,,	,,	hour
432,000	,,	,,	day
157,784,700	,,	,,	year of 365 days 5h. 49m.

If a watch went for a century, as there are some cases on record, its balance would make 15,778,470,000 vibrations. To give the reader an approximate idea of the extent of this number, let him be reminded that one milliard (1,000,000,000) of minutes has not yet elapsed since the beginning of the Christian era. How many people carry their watches three, four, or five years, and even longer, without having them cleaned? If we take the latter number, the watch will have made 788,923,000 vibrations, and after this gigantic task they still expect it to keep time to a few seconds! A consideration of these figures might make the public less exacting towards watchmakers.

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* Impure nitric acid.

THE
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PRESENTATION BY THE MAYOR OF LIVERPOOL.

Among the many magnificent gifts of the Mayor of Liverpool to the Town Council, we recently inspected one of considerable magnificence, which consisted of the mayor's jewel and badge of office, valued at £1,500. This magnificent ornament has, among other valuable articles, been presented to the Town Council, and is one of the most artistic pieces of workmanship we have seen for some time. It was manufactured by the well-known firm of J. R. Williams & Son, of Hatton Garden, and reflects no little share of credit on that firm, so well known for the manufacture of such articles. In the centre of the ornament is the coat of arms of the town, set round with brilliants, the border being formed with twelve splendid brilliants, intersected with *fleur-de-lis* of brilliants forming another outer border. The loop of the badge is in shape of a cockle-shell, with a large brilliant in centre.

One very new feature in the manufacture of the ornament is that the figures in the centre are modelled lifelike, from the gold itself, and which is entirely a new, but far superior style. The brilliants must have been selected with great care, and as a work of art we have seldom seen the article excelled.

New Town Clock at Ware.—Messrs. Gillett & Bland, of Croydon, have recently completed and erected the new clock and chimes for the parish church of the above town. The clock strikes the hours, upon the tenor bell of 24 cwt., and shows the time upon two 6 ft. dials. It is 7 ft. long, 2 ft. wide, and 3 ft. in height, and is driven by weights of nearly one ton. It has the "double three-legged gravity escapement" generally adopted by the makers in all their superior turret clocks. The clock and chimes seem to give great satisfaction.

When the Communists of Paris mobbed the residence of Thiers, they carried away his bronzes and curiosities, which were sold to dealers. The police subsequently seized, wherever they found them, articles bearing the private mark of Thiers, which he caused to be engraved or stamped upon his articles of *vertu*. Judge of his surprise to find many ornaments brought to him bearing this mark which he had never owned. The dealers had counterfeited the mark, and preferred to be robbed rather than confess the trick.

PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

4123. John Clayton Mewburn, of 169, Fleet Street, in the city of London, Patent Agent and Consulting Engineer, for an invention of "Improvements in watches."—A communication to him from abroad by Charles Delagrave and Ludovic Goillandeau, both of Paris, France. —Dated 6th, November, 1877.

4124. John Clayton Mewburn, of 169, Fleet Street, in the city of London, Patent Agent and Consulting Engineer, for an invention of "Improvements in clocks."—A communication to him from abroad by Charles Delagrave and Louis Maximilien Grignon, both of Paris, France. Dated 6th November, 1877.

4126. Henry Edward Newton, of the Office for Patents, 66, Chancery Lane, in the county of Middlesex, Civil Engineer, for an invention of "Improvements in the construction of buttons and studs."—A communication to him from abroad by Henri Burtey, of Paris, in the republic of France. Dated 6th November, 1877.

4133. John Matthias Augustus Stroh, of Hampstead Road, in the county of Middlesex, for an invention of "Improvements in means or apparatus for regulating the speed of clock work for telegraphic and other purposes. Dated 6th November, 1877.

4146. Charles Stuart, of 147, Queen Victoria Street, in the city of London, Mechanical Engineer, for an invention of "Improvements in the mechanism of instruments used for drilling holes in metals, such improvements being also applicable to other purposes.—Dated 7th November, 1877.

4167. Auguste Livache, of Genéve, Switzerland, Watchmaker, for an invention of "An improved watch."—Dated 8th November, 1877.

4197. William Hayes and Harry Hayes, of Birmingham, in the county of Warwick, Silversmiths, for an invention of "Improvements in the ornamentation of articles of goldsmiths' and silversmiths' manufacture."—Dated 9th November, 1877.

4235. William Wallace Le Grande, of the city of Louisville, in the county of Jefferson and state of Kentucky, United States of America, for an invention of "Watchman's time detectors."—Complete Specification.—Dated 13th November, 1877.

4281. William Hair Haseler, of Birmingham, in the County of Warwick, Goldsmith and Jeweller, for an invention of "Improvements in magnetic or mariner's compasses and in ornamenting the said compasses."—Dated 15th November, 1877.

Notices to Proceed.

2467. Peter Jensen, of Chancery Lane, London, has given notice in respect of the invention of "A new or improved pneumatic precision clock with lever escapement and worked hydro-pneumatically."—A communication tc him from abroad by Carl Albert Mayrhofer, of Vienna, Austria, Engineer.

2505. Frederick Eade and John William Blake, both of Birmingham, in the county of Warwick, have given notice in respect of the invention of "Certain improvemements in the manufacture of plated edge seals, keys, and spring keys, medals and edged charms, and other similar articles."

2894. Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, has given notice in respect of the invention of "Improvements in stop watches."—A communication to him from abroad by Henri Alfred Lugrin and Prosper Nordmann, both of the city, county, and state of New York, United States of America.

4235. William Wallace Le Grande, of the city of Louisville, in the county of Jefferson and state of Kentucky, United States of America, has given notice in respect of the invention of "Watchman's time detectors."

Grants of Provisional Protection for Six months.

4023. To Frank Wirth, of the firm of Wirth and Company, Patent Solicitors, at Frankfort-on-the-Maine, in the Empire of Germany, for the invention of an "Improved remontoir for mantel clocks."—A communication to him from George Crespel, a person resident at Frankfort-on-the-Maine, in the Empire of Germany.

2837. To George Henry Bricknell, of Birmingham, in the county of Warwick, Jeweller, for the invention of "Improvements in fastenings for buttons, shirt studs, solitaires, and other articles of Jewellery and dress.

4053. To Henry Conradi, of 8, Lower James Street, Golden Square in the county of Middlesex, for the invention of "Improvements in electro-metallurgy, and in apparatus connected therewith."—A communication to him from abroad by Emil André, of Ehrenbreitstein, in Prussia, in Germany.

4059. To Bristow Hunt, of Serle Street, Lincoln's Inn, in the county of Middlesex, Gentleman, for the invention of "Improvements in or connected with 'circuit-closers' for electric alarms."—A communication to him from abroad by Samuel S. Applegate, of Camden, New Jersey, United States of America.

4123. To John Clayton Mewburn, of 169, Fleet Street, in the city of London, Patent Agent and Consulting Engineer, for the invention of "Improvements in watches."—A communication to him from abroad by Charles Delagrave and Ludovic Goillandeau, both of Paris, France.

4133. To John Matthias Augustus Stroh, of Hampstead Road, in the county of Middlesex, for the invention of "Improvements in means or apparatus for regulating the speed of clock-work for telegraphic and other purposes."

4167. To Auguste Livache, of Genéve, Switzerland, Watchmaker, for the invention of "An improved watch."

4197. To William Hayes and Harry Hayes, of Birmingham, in the county of Warwick, Silversmiths, for the invention of "Improvements in the ornamentation of articles of goldsmiths' and silversmiths' manufacture."

Inventions protected for Six months on the deposit of Complete Specifications.

4235. William Wallace Le Grand, of the city of Louisville, in the county of Jefferson and state of Kentucky, United States of America, praying for Letters Patent for the invention of "Watchman's time detectors,' was deposited and recorded in the Office of the Commissioners on the 13th day ef November, 1877, and a Complete Specification accompanying such petition was at the same time filed in the said office.

Patents Sealed.

2720. George Lund, of the firm of Lund and Blockley, of 42, Pall Mall, in the city of Westminster, Manufacturers, for an invention of "Improvements in apparatus for synchronizing or setting clocks or other time-keepers." Dated 16th July, 1877.

Patents which have become Void.

3770. John Compton Weeks Jefferys, of Tottenham Court Road, in the county of Middlesex, for an invention of "Improvements in studs, solitaires, and other fastenings or ornaments for dress." Dated 31st October 1874.

Patents granted in British Colonies and Dependencies.

7660. Henry A. Lugrin, of New York, U.S., for "Improvements on stop-watches. (Perfectionnements aux montres à repos.)—5 years. —Dated 16th July, 1877.

7724. C. S. Hosely, of Elgin, Ill., U.S.A., for "A hunting-case watch movement."—Dated 9th August, 1877.

Certificates of Addition.

116,210. Collin, for "Public alarm clocks."—Dated 23rd January, 1877.

116,755. Drouillet, for "Magnetic barometers and thermometers."—Dated 3rd February, 1877.

92,259. Jesson, for "A metallic barometer."—Dated 7th February, 1877.

Patents Granted in Foreign States.

France.

117,298. Klopp, for "Chimes with an intentional and automatic motion."—Dated 7th March, 1877

117,325. Daubriac, of Toulouse, for "A box for keeping the furniture of watchmakers and jewellers."—Dated 7th March, 1877.

117,342. Frennelet, of Paris, for "A Clock-work, with or without striking train, going from 30 to 45 days without being wound up." —Dated 3rd March, 1877.

117,476. Bauchiron and Le Sache, for "Openings for inscriptions in rings, bracelets, and other trinkets."—Dated 12th March, 1877.

117,543. Collin, of Paris, for "A system of regulating clocks and electric chronofer."—Dated 16th March, 1877.

117,612. Charpentier, for "A ringbox."—Dated 19th March, 1877.

117,684. Amiet, of Besançon, for "A remontoir watch with a regulator." —Dated 28th March, 1877.

117,721. Spinder, for "So-called 'passe-partout keys' for watches, clocks, &c."—Dated 4th March, 1877.

117,730. Dejardin, for "Second pendulums of clocks."—Dated 24th March, 1877.

117,733. Pulvermacher, for "Improvements in apparatus or appliances for generating, applying, and regulating electric currents."—Dated 26th March, 1877.—(English Patent, 28th September, 1876.)

117,805. Vechte, of Dinan, for "An alarum."—Dated 4th April, 1877.

Germany.

1412. C. Schnabel, of Lautenthal, for "Reduction of the argentiferous oxides contained in zinc-dust."—Dated 20th September, 1877.

2172. A. Reitz, of Stuttgart, for "Improvements in studs for cuffs."—Dated 22nd September, 1877.

2819. J. Kruger, of Berlin, for "A silver balance."—Dated 11th October, 1877.

1582. J. Schmeidel, of Berlin, for C. Benoni, of Dunkelthal, near Maxschendorf, Bohemia, for "Obtaining mother-of-pearl glass by combining mica with white or stained glass."—Dated 15th October, 1877.

2306. G. F. Thode, of Dresden, for "Improvements in studs for collars." —Dated 15th October, 1877.

2417. C. Pieper, of Berlin, for C. A. Mayrhofer, of Vienna, for "A second clock, with anchor-escapement and hydro-pneumatic motion." —Dated 15th October, 1877.

2897.—F. Denckmann, of Hamburg, for "A stud for cuffs."—Dated 15th October, 1877.

875. R. Gottheil, of Berlin, for Veit and Nelson, of Paris, for "Jet trinkets."—Dated 16th October, 1877.

1662. R. Speltz, of Frankfort-on-the-Maine, for "Fastenings for earrings."—Dated 16th October, 1877.

2067. R. Stackel, of Berlin, for E. Muller, of Wolfsgraben, Austria, for "A thread-cutter for small screws for watches, machinery, &c."—Dated 16th October, 1877.

546. E. Lentz, of Dantzig, for "A stud for shirts and cuffs."—Dated 22nd October, 1877.

1840. Chr. Muus, of Lubeck, for "An improved stud for cuffs."—Dated 23rd October, 1877.

2623. A. Koch and F. Schaak, of Cologne, for "An electro-magnetic normal clock."—Dated 24th October, 1877.

840. E. De Limon, of Dusseldorf, for "Plates for safes."—Dated 1st November, 1877.

2697. E. De Limon, of Dusseldorf, for "Modifications in plates for safes." —Dated 1st November, 1877.

3586. F. Holzwarth, of Canstatt, for "An appliance for studs."—Dated 6th November, 1877.

3651. W. Motz, of Berlin, for "Separable studs."—Dated 6th November, 1877.

3691. J. H. F. Prillwitz, of Berlin, for A. Lion, of Paris, for "A novel kind of bracelets."—Dated 6th November, 1877.

Austria.

12. B. Heller, Sons, of Teplitz, for "An apparatus for facilitating the fastening and unfastening of studs."—Two years.—(Public.)—Dated 4th July, 1877.

United States of America.

192,812. Ebenezer Blackman, of New York, N.Y., for "Balance-spring hooks."—Application filed 3rd November, 1876.

193,312. Henry Abbott, of Newark, N.J., for "Lever winding and setting attachments for watches."—Application filed 5th May, 1877.

193,391. I. B. Woodruff, of Winsted, Conn., for "Alarm-clocks."—Application filed 20th June, 1877.

193,609. Caleb Hopkins, of Waltham, Mass., for "Slide-rests for watchmakers' lathes."—Application filed 8th February, 1877.

193,660. A. Kent and B. Kent, of Toronto, Ontario, Canada, for "Indicators for spectacles."—Application filed 22nd May, 1877.

193,663. F. Kroeber, of Hoboken, N.J., for "Calendar-clock dials."—Application filed 26th May, 1877.

193,701. Charles H. Graef, of Edgewater, N.Y., for "Bracelets, &c." —Application filed 12th May, 1877.

193,739. T. A. Willson, of Reading, Pa., assignor to himself, G. J. Willson, and C. B. Bishop, of the same place, for "Spectacle-frames." —Application filed 7th May, 1877.

193,758. Chas. A. Faas, of Wrentham, Mass., for "Lockets."—Application filed 5th May, 1877.

194,006. George W. Shingleton, of Indianopolis, Ind., for "Watchmen's time-detecters."—Application filed 21st November, 1876.

194,099. Thos. Moore, of Rock Mart, Ga., for "Fastenings for collars, cuffs, &c."—Application filed 15th June, 1877.

194,105. G. Newton, of St. Louis, Mo., for "Chronometer-regulators." —Application filed 24th July, 1876.

194,345. L. Franklin, of Platteville, Iowa, for "Spectacles."—Application filed 27th June, 1877.

194,470. J. E. Schonacker, of Dayton, Ohio, assignor of one-half of his right to Edwin W. Neff, of Detroit, Mich., for "Fire-proof safes," —Application filed 5th June, 1877.

Designs Patented.

10,159. Julius Hackenberg, of New York, N.Y., for "A bracelet."—Application filed 9th July, 1877.—Term of patent, 3½ years.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Amiel, William, & Thomas Fieldsend, trading as William Amiel & Co., Westgate, Bradford, jewellers, &c., &c., Oct. 25. T. W. Browning, sol., Bradford.

Rosen, Israel, 30, Great Passage-street, Hull, jeweller, &c., &c. Nov. 3. J. H. B. Chambers, sol., Hull.

Wilson, David John, trading as Greenbury & Wilson, Parliament-street, Harrogate, dealer in jewellery, &c., &c. Oct. 29. A. M. Bateson, sol., Harrogate.

Rivers, Henry Beale, Peverill-street, Nottingham, jeweller. F. Acton, sol., Nottingham, Nov. 7.

Bates, John Lantobie, Durham, watchmaker. Nov. 6. Welford & Son, sols., Consett.

Cheatle, Ebenezer, trading as Cheatle & Co., Buckingham-street, Birmingham, electro plate manufacturer, &c. Nov. 6. R. Taylor, sol., Colmore-row, Birmingham.

Myers, Michael, 25, Balsall Heath-road, Birmingham, jewellers' factor. Nov. 6. C. B. Hodgson, sol., 13, Waterloo-street, Birmingham.

Pinfold, George Valentine, Stony Stratford, Bucks, watchmaker. Nov. 6. W. R. Bull, sol., Newport Pagnell.

Holborn, Edmund, Bridge-street, Norwich, watchmaker and jeweller. Nov. 4. Sadd & Linay, sols., Norwich.

Hutchinson, Alfred, 58, Cheapside, Birmingham, late Hockley-hill, Birmingham, jeweller. Nov. 14. E. Jacques, sol., 40, Cherry-street, Birmingham.

Smith, Jacob, Middlesborough, jeweller. Nov. 9. J. W. Teale, sol., Middlesborough.

Higgs, William Willis, High-street, Shirley, watchmaker. Nov. 21. W. A. Killby, sol., Southampton, Dec. 10 at 2.

Levi, Lewis Lyon, 94, Varna-road, late Pershore-road, both Birmingham, jeweller. Nov. 24. C. Davies, sol., 25, Bennett's-hill, Birmingham, Dec. 10 at 11.

Rowbathan, John Benjamin, 39, Northampton-street, Birmingham, jeweller. Nov. 22. A. Pointon, sol., 5, Temple-row, West, Birmingham, Dec. 7 at 12.

Dividends under Sequestration.

Linz Rudolph, Greenock, watchmaker. 1st, Miller and Ferguson's, 71, Queen-street, Glasgow, Nov. 12.

Trustees Appointed.

Harris, Simon (Liq.), Union-street, Cambridge, jeweller. Tr., I. Silverton, 23, Summer Hill Terrace, Birmingham, jeweller.

Meetings.

Cohen, Moses J. (Bkt.), Newcastle, jeweller. At C.C. Newcastle, Dec. 6 at 11, exam.

Dividends.

Furneaux, Thos. G. (Liq.), Fleet-street, Coventry, watch tool dealer. 1st and final div. 5s.; Friday next and two subsequent Fridays, between 10 and 5; H. Merrick, Earl-street, Coventry.

Adjudications of Bankruptcies.

Cohen, Moses Jonah, Rye-hill, Newcastle, jeweller, Nov. 7.

Taylor, William Boyle, Roscommon, watchmaker, Nov. 12; sittings, Tuesday, Dec. 4, and Friday, Dec. 21. O.A., L. H. Deering. Sol.—Boxwell.

Applications for Cessio Bonorum.

Robertson, Wm., 22, Argyle-street, Glasgow, jeweller, presently in Glasgow Prison. Sheriff Substitute's Chambers, Glasgow, Dec. 7, at 10½.

Discharges Granted and Bankruptcies Closed.

Rann, Wm. C., Devonshire-street, Islington, jeweller's factor. (No property can be realised). Bktcy. closed Nov. 2.

Last Days for Lodging Claims.

Israel Selim (Bkt.), Vyse-street, Birmingham, jeweller. Claims by Dec. 10 to S. Dominy, Waterloo-street, Birmingham.

Applications for Discharge in Scotland.

Morrison, Robert, Bridge-street, Inverness, watchmaker, &c. Nov. 21.

Dissolution of Partnerships.

Baker, D. & Co., John-street, Pentonville, manufacturers of electric instruments. Oct. 16.

Bragg, T. & J., 18, Vittoria-street, Birmingham, jewellers. Mar. 31. Debts by Thos. Bragg.

Davies & Co., 1, Commercial-roa Gloucester, jewellers. Sept. 20.

Goodman & Son, New George-street, Hull, jewellers, &c. Oct. 3. Debts by Barnett Goodman.

Ketley, J. & J. H., Birmingham, metal brokers. Dec. 31. Debts by John H. Ketley.

Marsh & Clarke, Birmingham, manufacturers of electro-plated goods. Oct. 12.

Mendoza Bros., 4, Paradise-street, Liverpool, jewellers. Sept. 20. Debts by Henry Mendoza.

Rosenthal & Wiltshire, 4, Southampton-street, Fitzroy-square, jewellers. Oct. 1.

Speight & Jahn, 5, Northampton-square, Clerkenwell, goldsmiths and jewellers. Oct. 1. Debts by William Speight.

Tisley & Spiller, Brompton-road, optical instrument makers. August 25. Debts by Samuel C. Tisley.

Deutsche Uhrmacher Zeitung,

ORGAN DES CENTRAL-VERBANDES DER DEUTSCHEN UHRMACHER.

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R. STACKEL, HOF UHRMACHER.

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W H TILBY

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HOROLOGY.

(Continued from page 126.)

XXXI.—Its Relations to Astronomy.

By G. B. Miller.

OUR last article on this subject terminated with the consideration of the distance of the fixed stars and the mode of measurement. Though the topic does not bear directly on time, it is so linked with the whole subject of Astronomy, that a more extended consideration will not be out of place. Though an approximation has been made to the distance of 61 Cygni, a star of 5.6 magnitude, the result of such an annual parallax is scarcely sufficiently exact to satisfy the modern astronomer. The distances of other stars (for instance that of Sirius, the brightest star) are so great that the angle formed by the diameter of the earth's orbit is less than the one-third of a second. The star *a* Lyræ has no appreciable parallax. It is probable, whatever the degree of perfection to which instruments may be brought, that the distances of most of even the brightest fixed stars must remain for ever unknown. The only hope of a solution of the problem lies in taking the velocity of light as a means of measurement. The wave of light propagated from a luminous body undulates in a straight line at the rate of 196,000 miles per second. When it has reached the confines of our earth, however, it is turned out of its course by the difference in the density of ether and the terrestrial atmosphere. The quantity of refraction, however, is so small in relation to the whole space, that it may be disregarded. We have, then, a wave moving at a fixed rate, in a direct line, to furnish us the length of that line. If we knew the instant the wave left the body, and the instant it arrived at the earth, nothing more would be needed, since therein lies the entire problem. This problem may at some future period be solved by obtaining the difference in time it takes a ray to pass from one side of the star's orbit whose plane is nearly parallel to the plane of the terrestrial orbit. Could we draw that orbit in visible proportions in the celestial sphere, it would appear an ellipse in a horizontal position. As the star is supposed to be one of a pair called double stars (while their distance is so great that the two present but one object to the naked eye, they are resolved into two by means of the telescope in revolving around the other), the central one will furnish us with a point of departure, as in Fig. 1.

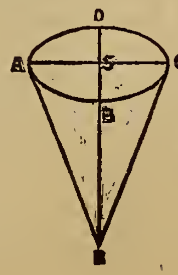


Fig. 1.

Let A, B, C, D be the supposed ellipse, and E the earth. If now we take B as the starting point of the revolving star, moving towards C, it must follow that the star will be continually receding from the earth, consequently increasing the distance, and it will appear to take a longer period for the star to arrive at D than for the time of translation through the other half of the ellipse, D, A, B, to the original supposed point of departure; for the light will take less and less time in reaching the earth. This will furnish the means of ascertaining the entire distance of both the primary and its satellite. Thus the difference between the greatest and least distance of the satellite from the earth is just the diameter of the orbit, and the difference between the observed times of the two semi-revolutions is twice the time taken for its light to pass over that diameter; the half of this distance being given in seconds and multiplied by 196,000, would give us the diameter in terrestrial miles. Observation gives the position of the orbit, as well as the place of inclination and apparent magnitude of the major axis; that is, we are able, by observation, to find the angle the visual ray makes across the orbit with the major axis, and therefore enabled to determine the angles that the extremities of the diameter thus measured in miles makes with the centre of the earth. We consequently have the same elements so successfully used in determining the distance of the moon by horizontal parallax, the difference in the two methods being that the bases are in reversed positions to the earth. M. Savary was the originator of this very ingenious method of ascertaining the distance of this class of stars. It must be remembered, however, that time is a very important consideration, as even the shortest revolution known is some 30 years, and a series of observations that must extend over that period would necessarily be subject to many inaccuracies; the success of the whole process, too, depends in the position of the orbit. With these two drawbacks to encounter, it will be a long time before this process is of practical application. There is no doubt, however, of its ultimate success, and that by its means the true distances of many of these systems will be ascertained.

The object of this diversion from our subject was to give our readers the mode of reasoning by which such distances are measured, and some slight idea of the ingenuity and reflection that have produced such wonderful results. The true beauty of these results can be known only to those able to follow the reasonings of the higher mathematics and mechanics. The general truths and the general principles, however, may be understood by many who would not comprehend the most simple equation if put in its algebraical form; and these very minds might be able to find the truth by ordinary reasoning in figures, that would seemingly be beyond their reach if expressed in symbols. The reader will be benefited even if he cannot at first follow the whole train of reasoning, for by reflecting on the subject his mind will eventually expand so as to take in abstract truths.

We have stated that light has a measurable velocity, though we have made no attempt as yet in our preceding chapters to show the method of its measurement. It is necessary to take this velocity into consideration in all observations of angles and distances in space. The study of the laws of light is, therefore, indispensable to a full understanding of the subject of our articles. We should be on a sea of conjecture were we to neglect the nature of light, its refraction, its aberration, and its composition, together with the law of the propagation of its rays. Light has hitherto been explained on two theories, both in many points coinciding in accordance to observed facts. The oldest theory held that light was the propagation of a material body, infinitely minute in dimensions and of instantaneous translation in space. This is called the corpuscular theory. There were effects, however, produced by the action of light that could not be accounted for by this corpuscular theory. It naturally would be suspected that these material particles of light falling against the surface of the earth must accumulate, and finally became visible as a mass, from accretion. Other and more forcible objections finally induced the hypothesis that light was rather the effect of undulations of a very rare ether, which fills all space and permeates all matter. The existence of this ether in space is proved by its retarding force on comets; for one or two of them have had their periods shortened by increased ellipticity of orbit, the result of a retardation in orbital motion. To whatever we may refer the propulsion of these undulations, the theory of which they are the base can satisfactorily account for all the phenomena; and, therefore, at the present day, all reasoning on light is conducted upon that theory, which is called the undulatory. The battle was strongly contested by the adherents of the respective theories. Like all other purely hypothetical reasoning, it would seem that the vehemence and animosity increased the nearer the two agreed with facts; but the undulatory actually kept growing in its accordance with phenomena, until its opponents, drawing off from the contest one by one, left it in the field a complete victor, when Arago and his colleague settled the question by the successful performance of a decisive test, admitted as such by both parties.

It is hardly worth our while to enter into the argument, though much romance is to found in the early history of the discussion. Strange that mathematical minds could so stray from the realms of reality to adopt the insane, illogical systems of reasoning of the scholiasts and metaphysicians.

We shall assume the undulatory theory to be true, and in all the subsequent observations will take it as a sufficient ground to base any explanation of facts observed. Light being the stimulus to the eye in form of waves, the same as sound is that of the ear by undulations of the atmosphere, the comparison is so close that nearly all the phenomena of light can be explained by the same course of reasoning as those of sound. A ray of light proceeding from a luminous body always pursues a straight line until it meets with some obstacle, and then it is diverted, either by reflection or refraction, and in some cases by both. Suppose a ray of light falls upon a plane surface as at B proceeding from A, it will be reflected from the surface of F, in the line B, C. Now, it is a well-known law that the angle of incidence, A, B, G, is, and must be, equal to the angle G, B, C; provided the ray is at a certain angle of incidence all the rays will be reflected at the point B to C; but if the ray proceeded from A′ to B, there would be a distribution of the amount; part would go through F, in the line B, H, thence proceeding in the direction H, E, while the balance would be reflected at the point C′. In all cases it must be remembered that the angle A′, B, G is exactly equal to the angle C′, B, G. This equality of angles is expressed in the rule that "the angle of incidence is always equal to the angle of reflection." This law is good for all surfaces of reflection, for we may consider that a curve is made up of an infinite number of planes, and that from each the same series of rays could not be parallel, for in the curve there could be no planes parallel to each other, however infinitely small we may conceive them. We have in this respect a means of determining the direction a ray of light would take after being reflected, and were all the light incident to a surface to be reflected the image of an object of observation would have all the illumination of the original. We find that it is not the case, and on inspection we can see that a portion of the light has been absorbed by its passage through the material of which the reflecting plane is a surface. Whether the reflecting material is transparent or not, this effect will inevitably follow. Suppose a transparent medium, a part of the ray will be found to have passed through the medium, but not in the same straight line. By inspecting Fig. 2 we may see that a ray of light, propagated from the point A, may be divided into two rays—one reflected to C, the other passing through in a line B, H, and from that point resuming its perallelism to E.

Except in the reflecting telescope and the reflected light of

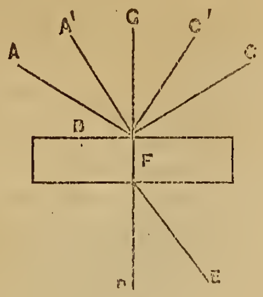


FIG. 2.

the planets, we have but little to do in respect to that part of the ray, B, C. It seems, then, that a ray of light must lose unless it falls perpendicular G, D to the plane B; but it does lose some, even then, for a plate of even the most transparent glass will not transmit all the light it receives. We nevertheless use this deflective quality of light for all instruments, as it plays an important part in all the subsequent observations.

The proposition may be stated in general terms thus: A ray of light suffers a deflection when it passes through two media of unequal density. No body of observation, then, is in the place that it should be if the ray of vision was a perfectly straight line. This is called refraction; and in terrestrial measurements it plays a very important part. We may assign it a very high place in celestial observations when we take into consideration that our atmosphere is about 45 miles in extension from the earth, and moreover that it is of very unequal density in itself; that is, the compression by its own weight makes the density diminish from the surface of the earth so much that it is estimated that ·9 of all the atmosphere is contained within a space of five miles from the earth. If a ball was let loose from the top of a tower or mountain, two forces would finally determine the course, or rather the path, the ball would take in falling to the earth; if it is dropped, its course will be in a straight line, directed to the centre of the earth; if some propelling power is given, it would describe a curve, which, in its turn, would be determined by the amount of propelling force applied in relation to the attraction of gravitation. Now, if we conceive a ray of light projected in space to reach the confines of our atmosphere, we shall find that in its passage through the forty-five miles it will be deflected from its true course; and as the atmosphere differs in a gradual ratio of density, the new line would assume a curve; but as the densities diminish as we leave the surface, this curve would not be an arc of any given circle, and as the visual ray must follow the line in which it meets the eye, we would see the object in the direction of the tangent of the last curve that meets the eye. Such being the fact, it follows that when a star or other heavenly body is projected in the field of a telescope, its observed place is too high or too near the zenith. In Fig. 2 the ray emanating from G will pass in a straight line through the points B, H. The atmosphere is of the same form as the earth; therefore if a ray is transmitted through the atmosphere from any point in the horizon, it will be compelled to traverse the air in the longest line to the earth's surface; but it will also be more deflected than at any other point of passage. Then, to table this amount of refraction, we should take the horizon at 90° and zenith at 0°; for it is plain that the amount of refraction must diminish from the horizon to the zenith, where it is nothing. Not only is the ray diverted by the air, but the amount of deflection is variable, depending on the temperature and weight of the atmosphere.

(*To be continued.*)

ANOTHER large diamond, weighing about 150 carats, has been found in the south side of Kimberley Mine.

QUICK SPEED DRILL FOR CLOCKMAKER'S.

MESSRS. SELIG have brought out a new machine which will, they claim, surpersede the use of the breast or fiddle drill. It consists of a frame, a spindle with the socket for the drill, a pulley with a spiral spring, and a hollow casting which acts as a fly-wheel, and also serves as a case to contain the ratchet and pawl necessary to prevent the possibility of the motion of the drill becoming reversed. The action is as follows:—The workman on drawing his hand towards him actuates the drill, and at the same time tightens the springs attached to the pulley, which springs on the tension of the hand being relaxed, reverses the motion of the pulley, and takes up the slack of the cord; but the motion of the drill is not reversed, owing to the ratchet and pawl in the fly-wheel, and to the rotation of the fly-wheel itself. There is thus obtained for the drill a constant revolving motion, with a speed which can be regulated to suit any metal from the hardest to the softest, while the feed, which is effected by the hand, is at all times felt and controlled.

PETITION OF THE FRENCH WATCH MANUFACTURERS.

FROM the *Révue Chronométrique* we extract a petition presented to the Minister of the Interior. It has for its object the nomination of the Jury of Award by the exibitors, and was signed by over 200 Paris and Besançon firms. After the usual preliminaries, it runs somewhat as follows:—

"Monsieur Le Ministre,—You are well aware that the products of horology, from the scientific chronometer to the turret clock, embrace an immense variety, and that the complication of mechanical effects, perfection of the various organs, etc., can only be appreciated and judged by men having a thorough practical experience and a skill beyond question. Besides being capable of judging the merit of work, they must also be familiar with the science of horological observations, a knowledge which nothing else can replace."

After some further details, it continues:—

"We beg you to believe, Monsieur le Ministre, that we, exhibitors in the horological section, are also meeting the wishes of the Commissioners in asking your permission to appoint ourselves by suffrage the French members of the Jury of Award; because unable to arrive at decisions themselves, from want of experience in our art, they would have to appeal to other authorities. The voting would offer no difficulty, as four-fifths of the exhibitors reside in Paris and Besançon, and a meeting in each of these towns would suffice.

In granting us this favour, your Excellency will perform an act of justice and prevent those incorrect awards which do so much to discourage talent, industry, and devotion."

AWARD FOR THE BEST ESSAY ON SILVERSMITH'S WORK.

THE Council of the Society of Arts offer the sum of £100 (placed at their disposal by Messrs. Watherston and Son), together with the Society's Medal, for the best essay on the Art of the Silversmith, past and present of all nations, with practical suggestions for its future development.

The Essay must be historical as well as practical, and should point out the *chefs d'œuvre* produced in various countries.

It is necessary that the obstacles which have tended to retard the progress of the Art in England should be set forth with a view to their removal, and that suggestions should be made for improvements in the various branches of the Art. The names of the Judges will be published hereafter.

The premium will not be awarded unless an essay of sufficient merit be submitted.

CURIOSITIES OF CLOCKS AND WATCHES.

(Continued from page 127.*)*

ELLIS, in his "Original Letters," gives us a copy of the epistle which Sandys wrote to Cecil with the clock, on December 28th, 1563. The following extract will show with what grace the Bishop made this gift: "Suche ys the barreness of this countrie that yt bringith nothing forth fitt to remember youe withall, and therefor I am bold to present youe with an olde clock, in the stead of a new year's gift, which I trust ye will the rather accept because yt was your olde master's of happy memorie King Edward's, and afterwards your lovinge and learned brother's, Mr. Cheekes; and synce, hys who thinkith himself in many respectes most bounden unto youe."

In "A Booke of Fees and Offices, primo die Augusti anno primo Regine Marie," 1553, preserved in the Library of Dulwich College, is an enumeration of artificers of various kinds, and among them we find a "clocke-keper, John de Moylym," and a "clocke-maker, Nicholas Ursewe."

In an account of new year's gifts presented to Queen Mary on January 1st, in the third and fourth years of her reign, 1556, we find the following: "By Nicholas Vrsin, a faire cloke, in a case, couer with blake vellat, and by John Demolyn, a cloke with a lambe on it of copper, guilt." Allowing for the caprices of ancient orthography, we conclude that these two donors were the same identical persons as those mentioned in the last paragraph, and were also skilled horologists settled in England. Nicholas Urseau is named in certain State papers, under dates 1572 and 1590, as Queen Elizabeth's clock-maker.

In 1560, Tycho Brahe possessed four clocks, which indicated hours, minutes, and seconds; the largest had but three wheels, the diameter of one of them being three feet, and containing twelve hundred teeth, a proof of the imperfect state of clockwork at that period; Brahe also observed irregularities in his clocks dependent upon changes in the atmosphere.

At a meeting of the Archæological Institute held on June 3rd, 1853, Mr. O. Morgan exhibited a table-clock of about 1560-80; and at a meeting of the same Institute, held on January 3rd, 1851, Mr. N. T. Wetherell exhibited a hexagonal table-clock of the latter part of the reign of Elizabeth, the works of which were formed of brass.

In the South Kensington Museum is a clock in gilt bronze, with a perforated case, supported in a baluster-shaped stem, with chiselled cartouche ornaments. The summit is surmounted by a palm tree in gilt bronze. It is of Italian work, about 1570. The entire height is seven inches. It was purchased for £10.

Queen Elizabeth's favourite, the Earl of Leicester, who spared no expense in the adornment and improvement of his princely seat at Kenilworth, caused a striking clock to be placed in the Cæsar tower, the oldest portion of that castle. This clock, as we gather from a contemporary description of it, had two dials, one facing south and the other east; they were of large size, and coated with a light blue colour, having the figures gilt. The clock bell was good and shrill, but we are told that it "sang not a note" all the time Queen Elizabeth was a guest of the Earl, in the summer of 1575. The instrument was stopped, and the hands of both dials remained pointing at two o'clock. Laneham, writing at the time, gives the following account of the event: "Too dyalz ny unto the battilments ar set aloft upon too of the sidez of Cæzar's tour; one east, thoother soouth; for so stand they best, to sheaw the hoourz to the tooun and cuntree; both fayre, large and rich, by byse for ground, and goold for letterz, whearby they glitter conspicuous a great wey of. The clok-bell, that is good and shrill, waz commaunded to silens at first, & indeede sang not a note all the while her Highnes waz thear; the clok stood allso still withall. But mark now, whither wear it by chauns, by constellation of starz, or by fatel appoyntment (if fatez & starz do deal with dialz), thus waz it indeede. The handz of both the tablz stood firm & fast, allweyz pointing too just too a clok, still at too a clok."

In 1577 Moestlin had a clock which made 2,528 beats in an hour; and by counting the number of beats made during the time of the sun's passage over a meridian, the sun's diameter was determined to be 34 min. 13 sec.

In the "Calendar of State Papers," temp. Elizabeth, under date April, 1582, we find a note of things considered of by Thomas Bedwell, among which was an idea to make a clock to go by water continually without settings. This, no doubt, was some inventor's crotchet in the air about a perpetual clepsydra, but it does not appear that the authorities fostered it.

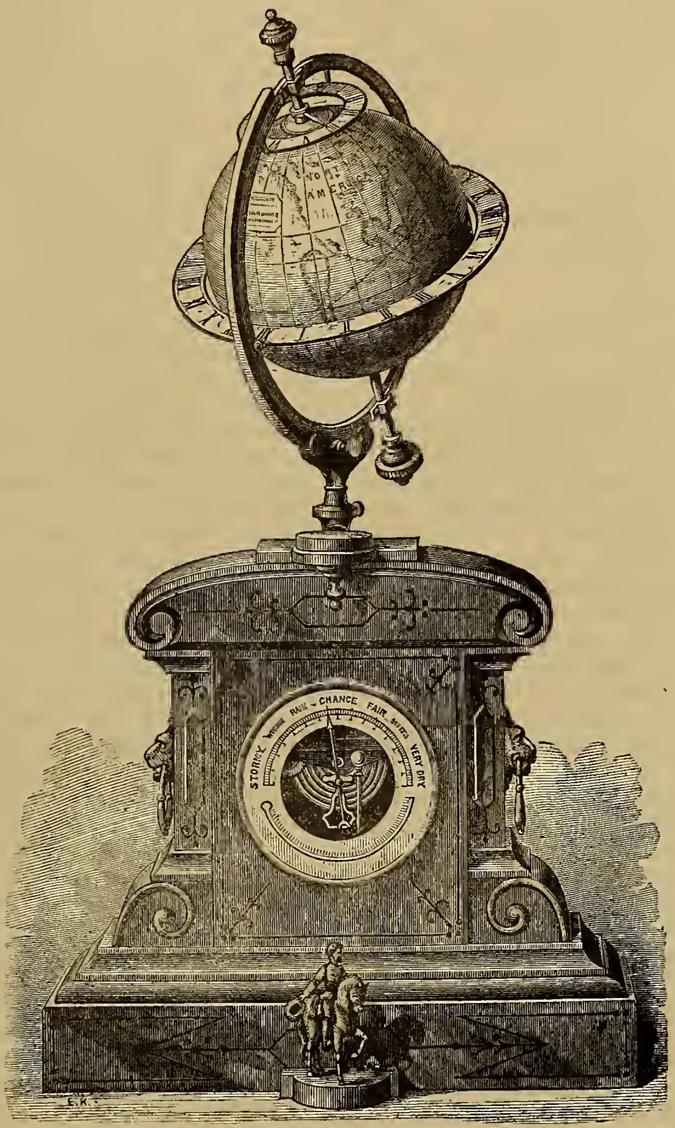
One of the most important discoveries in relation to the history of clocks, because upon it their accuracy mainly depends, was that of the isochronism of the pendulum, which Galileo, the famous astronomer, in 1582, when a student of medicine at the University of Pisa, happened to make whilst engaged in the cathedral of that city in the contemplation of the lamps which swung by chains from the roof. He observed that their oscillations, whether great or small, were performed in equal times, the truth of which important fact he tested by the beats of his own pulse. He afterwards discovered that the shorter the pendulum the less was the time of its vibration—a fact which was ultimately demonstrated by Sir Isaac Newton. A pendulum of 39.2 inches will oscillate once in a second precisely in the latitude of London; but the pendulum of a clock adjusted to time in that place requires to be lengthened if taken nearer either of the poles, or shortened if taken towards the equator. The first use that the young philosopher made of his discovery was to ascertain the rate and variations of the human pulse.

Its application to clockwork was an afterthought, for which he has not the credit, the merit of the invention, as we have stated in our chapters on the "History of the Measurement of Time," being commonly attributed to Christian Huyghens, about 1657. A pendulum clock was, however, made by Richard Harris, a London artist, for St. Paul's church, Covent Garden, in 1641 or 1642. Inigo Jones, the architect of this church, having been in Italy while Galileo was living, possibly communicated to Harris what he had heard there of the pendulum. It is, moreover, said that the first pendulum-clocks made in England were constructed in the year 1622, by John Fromentel (or, as variously spelt, Fromantil, Fromanteel, and Formantil), a Dutchman. No doubt the date given is incorrect, and some authors fix it as 1656, and others as 1662. Evelyn, in his Diary, under date May 3rd, 1661, records that he "return'd by Fromantil's, ye famous clockmaker, to see some pendules." The *Commonwealth Mercury*, of Thursday, November 25th, 1668, contains the following advertisement on this subject, by which it would appear that the mechanician's first name was not John, and that all the dates above enumerated are incorrect: "There is lately a way found out for making clocks that go exact and keep equaller time than any now made without this regulator (examined and proved before his Highness the Lord Protector by such doctors whose knowledge & learning is without exception), & are not subject to alter by change of weather, as others are, & may be made to go a week, or a month, or a year, with once winding up, as well as those that are wound up every day, & keep time as well; & is very excellent for all house clocks that go either with springs or weights; & also steeple-clocks, that are most subject to differ by change of weather. Made by Ahasuerus Eromanteel, who made the first that were in England. You may have them at his house, on the Bankside, in Mopes Alley, Southwark, & at the sign of the Maremaid, in Lothbury, near Bartholomew Lane end, London."

(*To be continued.*)

THE TIME GLOBE.

AMONG the exhibits at the late Exhibition in Philadelphia was a novelty in horological manufacture, which was universally admired, and met with such marks of approbation. We allude to the "Time Globe, invented and patented by L. P. Juvet," of Glen Falls, N.Y. The invention is very appropriately designated, because it is in every way what its name implies; in fact, it is a practical miniature representation of the earth's daily motion, and shows at a glance the time, longtitude and latitude of any place in the world, and the difference of the same between two or more places. This remarkable contrivance has the appearance of an ordinary clock, on the top of which is mounted a terrestrial globe with meridian and hour circle, held by its suspending standard at the proper inclination of 23½ degrees to the plane of the ecliptic. The clock-like support encloses, however, only an aneroid barometer, which shows its face at the place usually assigned to the dial. As will be seen by accompanying illustration, it is encircled at the equator by zone dial inscribed with the twenty-four hours of the day, and the fractions thereof, while an ordinary clock dial encircles the north pole. The zone dial is stationary, while the terrestrial globe revolves on its axis once in twenty-four hours by means of a self-winding movement placed within the globe. As it revolves it indicates the various meridians on the zone dial, while the mean time of the place of observation is shown in the ordinary way, by the two hands of the dial at the north pole. It has a sliding vernier, divided into 360 degrees, which enables to ascertain the latitude of localities, or the proper degree of inclination of our own or any heavenly body illustrated. By setting the globe at the proper angle of inclination, giving the poles the proper direction north and south, and letting the light, properly applied, fall on it, we are shown not only the amount of light and darkness each country has, but the very time at which it has it. The works are perfectly simple, and if out of order may be cleaned or repaired by any watchmaker able to take care of an ordinary watch.



Duplicates of all parts may be obtained by applying to the inventor. The movement is made of two plates, with the mainspring and barrel in the centre and its arbor extending through the globe at the south pole, outside the meridian ring, where its end is provided with a thumb piece serving to wind up the clock. The shaft of the first wheel extends through the plate and receives a triple wheel intended to transfer to the minute, hour, and globe wheels their proper motions. A fange with pins and screws secures the axis of these wheels to the upper plate, which axis extends through the globe at the north pole to the meridian ring, where it is firmly secured by a set screw, and forms with the arbor the axis upon which the globe resolves.

The vast usefulness of this fresh addition to the products of our art is beyond question, especially when we consider its great simplicity and the fact that it can be manufactured at a figure which brings it within reach of everybody. It will also be a perfect boon to those whose task it is to teach geography. The most elaborate description of the general appearance of the earth in the universe, of its motions in space, of the causes producing night and day, or the difference in time between two countries &c., would fail to convey that clear idea to a youthful mind which a glance at the Time Globe in true position and in motion affords. Gen. Eaten, of the National Bureau of Education, had such a high opinion of its value as an educator that he at once ordered one for his department, and numerous other authorities on educational matters have since testified their approbation in a similar manner.

It is almost unnecessary to say that the International Jury of Award granted the inventor a diploma of the highest merit and the medal of the United States Centennial Commission.

We may add that Mr. L. P. Juvet intends to exhibit his invention at the forthcoming Paris Exhibition.

THE JEWELLERY TRADE IN 1877.

As most people having any knowledge of, or connection with, this great industry will admit that it may be generally described by the one small word "BAD," written in large capitals, it might seem unnecessary to say much respecting it. But if business requires attention in times of good trade, every sound tradesman will recognise that it requires ten times more attention when things are going wrong. So, in the year just passed, when most jewellers have been working short hours, when large numbers have had no work at all, and hundreds have sought refuge from enforced idleness by seeking employment in other branches of industry, it is certainly desirable to know the causes of this state of things, and to discover, if possible, how such mischievous results may be obviated.

To begin with, the jewellery trade is a product of a certain state of civilisation, which demands articles of rare and valuable material, wrought with some delicacy and refinement, and to be used as objects of personal ornament. This trade ministers not to the actual wants, but to the taste for luxuries inherent in human nature; and therefore it must be expected that when periods of industrial and commercial depression occur, the demand for luxuries, and therefore for jewellery, will be proportionately, if temporarily, diminished. But this is only half an answer to the question involved. The taste for decoration begins with the savage when he tattoos his body, fashions his anklets and armlets, strings his necklaces of beads and wampum, and decorates his dress, his utensils, and his weapons. In some respects this desire for ornament is even stronger with the savage than with the civilised man. And to show how strong, how irrepressible this taste is, we have only to examine periods of depression in the jewellery trade, and we shall discover that the real demand for such adornment is very slightly diminished, though that demand is supplied in a less expensive manner. The gold gives place to the copper or gilt reproduction—the real to the imitation. The ornament must be had; but where the sovereign was spent before, the shilling must now suffice. A striking illustration of this fact is given by the course of the jewellery trade for the year. Probably more brooches, lockets, and earrings, and more chains of various kinds, have been made in Birmingham during the year 1877 than in any previous year; but the quality and fashion have been altogether different. Even in the best gold jewellery the work, if artistic, has been simpler and slighter; while as to gems, except in cases of articles where the gems are the sole feature, one gem has been sufficient for one article, whereas in years of plenty a dozen or twenty would have been employed. In common gold jewellery the commonness has increased so sadly that a strong popular revulsion is setting in against "bright gold," as it is called. Gilt jewellery still hold its own, but the great demand has been for personal ornaments in silver. The enormous quantities of jewellery made in this material we have no exact data for calculating; but a slight glance round on society at large will suffice to convey an idea of its extent. In one respect the change is good. Silver, if fairly pure, is really a precious metal, and is a great stage higher than the compound, often one-third gold and two-thirds alloy, which is complimented by the title "bright gold."

But, it may be asked, If so much jewellery has been made in Birmingham during this current year, why is trade so bad? This brings us to the darker side of the picture. The best work gives employment for skilled men; the common can be made by boys, women, or girls. The best work can be wrought only by the human hand; but, in order to supply the cheaper quality, the manufacturing jeweller procures machinery, and an engine, either gas or steam. Again, unfortunately, in the jewellery trade there is always growing up a large number of young persons who have no proper ideas or modes of work, and who are not, and never will be, jewellers. Even in the best shops, where apprentices remain with competent workmen-instructors until they are eighteen or nineteen years of age, only about one in every three or four becomes a skilful jeweller. This arises in large measure from the lamentable Art ignorance of even what are called well-educated English boys, and the marked disinclination of such boys to continue their Art studies in schools or classes in the evenings after leaving their employment. And if this is the case in the best manufactories, where the strictest tests are applied before taking apprentices, it may be imagined how much worse the state of things is where no such care is exercised; where the boys are soon set to work on their own account without further instruction, except what they obtain by chance, and where the manufacturer aims only at securing a margin for himself while meeting the demand for cheapness on the part of the exacting buyer. In these shops thousands of men grow up whose only claim to be jewellers is that they can solder and polish, but who have never caught a ray of the divine beauty of Art, which should be the soul of their calling. These people have full employment as long as trade is brisk and orders are numerous; but the moment the orders cease, and times are bad, they are sent adrift, and fresh relays of boys, or perhaps girls, and gas-engines, supply their places. This is what has taken place during the year 1877. At Hanau and at Pforzheim, the great centres of the German jewellery manufacture, similar phenomena are observable, but they are more regular, and have thus less of the nature of crises. In Germany there are two working populations: those who work in manufactories, and those who execute the cheaper and commoner work at their own homes, the whole of the family generally assisting. The apprentice who becomes an indifferent workman soon drifts into the position of an out-worker, and then he takes his chance of common orders. But the German workman is so generally thrifty and abstemious that he can live where his British competitor would starve; and, moreover, he is frequently beforehand with the bad weather.

It is a notable fact, affording proof of what has been said, that the manufacturers of best English jewellery, whose proportion of boys to men is the smallest, and whose men are the most skilful in their art, have been least affected by the bad trade of 1877. For it is a great mistake to suppose that it is one professional designer who can make or mar a manufactory. Certainly, an artistic eye and a skilful directing mind in the management are essential; but it is the multitude of little thoughts of the men themselves that gives tone and beauty to good jewellery. An inartistic eye will spoil the best design;

whereas men of taste, skill, and judgment are continually pushing a good notion further, diversifying and originating. It is this which is the secret of the success of some houses; and this is the true way by which workmen, whether jewellers or others, can keep up prices for their work. At the request of the Factory Acts Inspector, a return was made two months since, by one of the largest and most successful houses, as to the prices paid for day and piece work respectively at the present time, as compared with those paid ten years ago. It was discovered that, although no strike or struggle had ever taken place there between employers and employed, the rate of wages had increased at rates varying from 15 to 20 per cent.

What are the prospects for the coming year? The prospects of the great silver jewellery development are probably bad. Now that unwise manufacturers, lured on by the demon of cheapness, are debasing their so-called silver till it is not worth 3s per oz.; now that they are adding common metal edges and supports to silver facings, they are helping to produce a sure change in public taste—a change which may be sudden and disastrous. The same disgust which was felt for "bright gold" will surely be felt for this alloyed silver, and many foolish tradesmen will be left high and dry upon the shore, perhaps with huge stocks returned upon their hands, and with workmen spoiled for better work. Those houses whose gold will assay, and whose silver will assay, at something near what they profess it to be, if not doing so large a trade, are doing a much safer one than those whose working material has been debased. The sound art manufacturer and the real art workman have certainly improving prospects. The mere copyist and pretender, whether master or man, who constantly follows the original designer as the jackal does the lion, these have a decreasing prospect.

A retrospect of the jewellery trade would not be complete did it omit to refer to commercial failures and to the long credit system. A feverish desire for rapidly-extended business has led to an unduly-extended system of credit, to a greater extent in the jewellery trade than perhaps any other. Young men without capital have been started and supplied with goods almost without limit. The results have been like those in a game at hazard. Ultimate gain sometimes ensues; but serious—nay, ruinous—loss is equally probable, and during this year many a manufacturer's sad experience has shown him how much it has been the rule. Jewellers especially seem to forget that extended credit means, not only loss of profit-making capital, but also extended risk. Nor are the ends of business ultimately answered so well. During this period of depression those who give longest credit have been especial sufferers. Their customers, weighed down by heavy long-drawn burdens of debt, have failed to remit, if they have not failed utterly, and thus the creditors themselves have been paralysed. Those whose terms have been shorter have been less severely affected.

Some jewellers conceive that the only remedy is to cast aside the factors, or middle-men, and to go direct to the retail shops. But this is a large question, and the change may only increase the difficulty. A bad system of credit would be even worse, if carried out on a more extensive scale. Besides, no man can live two lives now-a-days. A jeweller, to be eminent, must be an art-manufacturer: a factor, to be successful, must be a clever commercial man. The two qualities cannot easily be united. The more attention a principal devotes to commerce, the less devotion he will give to art; and the result will soon tell on his productions. On the other hand, if he pursues an art industry conscientiously, he will soon have enough customers. Certainly he must study the public taste and the tendency of things, but a little business acumen will suffice to lead him in the right path. Meanwhile taste, if slowly, is really improving. The gaudy mixtures of coloured gems in jewellery are now no longer tolerated. The one-colour theory is being more generally recognised; the theory that a jewel should have but one prevailing colour, and that the dress on which it is worn should harmonise with it. Then the forms of articles in jewellery are less florid; they are simple, and generally have a geometric basis. The Castellani collection—though practically locked up from Birmingnam artists and workmen—has not been without its use. The delicate wire decoration, now often adopted, is on a good classic plan, and the spaces well arranged. Lastly, and perhaps best of all, we are no longer getting all our best designs from Paris. English jewellers are beginning to have ideas of their own, and are no longer content to follow the lead of the modern Athenians. It has been much remarked lately by visitors to France that British styles of jewellery are beginning to prevail there, in a place of the peculiar Parisian style which has so long held sway. All these things are healthy signs; and if the Birmingham jeweller is only true to himself and to his calling, if he resolutely sets his face against mere cheapness and sham, if he regards his manufacture as an art and not as mere commercial speculation, if he insists on excellence in finish and style, he need not fear to lose his position amid all the foreign competition that can assail him; but he will find his wares annually more esteemed in the markets of the world.—*Birmingham Daily Post.*

PRACTICAL INFORMATION FOR THE TRADE.

To Blacken Brass.—A solution of nitro-muriate of platinum will blacken brass quicker than anything else; but possibly 2 oz. of corrosive sublimate, dissolved in a quart of vinegar. This solution is brushed over the brass, allowed to remain till the latter is black; it is then wiped off, and the brass cleaned and blackleaded. This, however, does not improve the brass as brass.

The following receipt makes a good liquid polish for silver plate—viz., 3 to 4 drachms of cyanide of potassium, 8 to 10 grains of nitrate of silver, and 4 oz. of water. Apply with a soft brush, wash the object thoroughly with water, dry it with soft linen cloth, and polish with chamois skin. Neither whiting nor powder of any kind should be used for cleaning and polishing, they only destroy and scratch the silver.

To Bush a Wheel.—It often happens that a watch stops from a wheel not being properly centred in itself; consequently one side takes too deep, while the opposite too shallow into the pinion it drives. Such a wheel likely is of the proper size and with good teeth, but the difficulty is it lacked centring when fitted to its pinion. I have found an easy and excellent way of correction—viz., take a piece of lead about the thickness of a silver half-dollar clip, and file it nearly round to fit into one of the larger steps in a step chuck of the American lathe. Screw it fast into the lathe, and while running centre and drill a hole.

Poisoning by Earrings.—Two young girls in Paris suffered from blepharitis, and one of them also from an inflammation of the lower part of the left auricle. All the usual remedies proved inefficacious, but both patients quickly recovered after their copper earrings were discarded.

The Age of Gold.—One is almost inclined to think that the fairy tales chronicled in children's books have come to be realized when we read of a horse with golden shoes. Such an exceptional circumstance as shoeing a horse with gold has, however, taken place at Edinburgh, where by instructions of a wealthy American lady, Miss Thomson, who has resided there for some time, Messrs. Marshall and Sons, jewellers, George Street, have manufactured a set of horse-shoes of solid gold, costing between 200*l.* and 300*l.*; and on the 30th November, a mare belonging to that lady was shod in the precious metal by Professor Baird, veterinary surgeon, of St. James's Place. The nails used were also of gold.

INTERESTING FACTS ABOUT METALS.

(*Continued from page* 110.)

Britannia metal is an alloy of equal parts of brass, tin, antimony, and bismuth; or, better and safer, 100 parts of French pewter, 5 of antimony, and 5 of brass.

Bronze contains copper, tin, and lead.

Bell metal contains 5·6 parts of zinc, 10·1 parts of tin, 80 parts of copper, and 4·3 parts of lead. All of the foregoing alloys are more or less wasted, or dissipated by the action of heat, owing to the ready oxidation, or the volatilisation, of the lead, or of some one or other of its constituents.

Bismuth melts at about 518° F. It is but little oxidised by contact with air. If strongly heated, it burns with a bluish flame; at a high temperature it volatilises freely. It is obtained from its ores by simply exposing them to heat.

Copper melts at about 2100° to 2200° F. It is very ductile, malleable, and tenacious. At very high temperatures it is slightly volatile. It is unaffected by dry air, but in the damp becomes coated with an adherent green crust. When exposed at a red heat in the air, it is rapidly oxidised, and becomes encrusted by a black scale. At a high temperature copper burns with a green flame.

Nickel is somewhat less fusible than pure iron: this would put its melting point at about 3000°F. Like iron, it is capable of becoming magnetic, but loses this property at temperatures above 660° F. Though combining readily with oxygen, it is not oxydised when highly heated, since heat drives off the oxygen as fast as it is fixed.

Cadmium melts at about 500 F. It is commonly associated with ores of zinc, and being a very volatile metal distils off when zinc ores are roasted.

Manganese has a high melting point, but fuses when exposed to the heat of a good wind furnace. It has a strong attraction for oxygen, and will even take it from water at low temperature.

Iron, intrinsically the most important of the metals, fuses at temperatures dependent on it purity. When containing carbon or in the condition of cast iron, it melts at 2786° F.; but when pure, or in the condition of wrought iron, a temperature of 3280° F. is necessary to melt it. Iron softens before melting, and possesses in a marked degree the property of welding. It has powerful affinities for oxygen taking it from the air when moist—a circumstance which explains the fact that it is seldom found in a pure or metallic state, except in meteorites. Dry air at ordinary temperatures does not affect it, but when heated to redness it absorbs oxygen, and becomes coated with a scale of black oxide. When in a finely divided state, the metal burns while falling through the air, and even in the condition of ordinary filings it burns with brilliant scintillations when thrown into a fire or the flame of an ordinary gaslight Its high point of fusion renders it an admirable protection of woodwork against ignition from neighbouring fires, though its rate of expansion, as shown in the table, somewhat vitiates its protective action in cases of fires, from its tendency to warp from unequal expansion.

Tin melts at the temperature of 455° F. It is not acted on to any extent by air or water. When exposed to a temperature somewhat above its melting point, it absorbs oxygen greedily, and is converted into a whitish oxide, known technically as pasty powder.

Zinc melts at about 770° F. It undergoes a series of remarkable changes under the influence of heat. At ordinary temperatures it is comparatively brittle. Between 250° and 300° F., it is quite malleable, and in this state may be readily rolled or beaten into sheets, which have the valuable property of retaining their malleability when cold. The brittleness of the metal at ordinary temperatures is doubtless to be attributed to its chrystalline structure, which is probably effaced during the operation of rolling at higher temperatures. At 400° F. zinc becomes so extremely brittle that it may be readily powdered. Zinc is very volatile at a bright red heat, and in the presence of air burns with a bluish green flame.

Antimony melts at about 800° F. Like zinc, it boils and volatilises, but at a higher temperature—this phenomenon occurring with zinc at a bright red heat, and with antimony at a white heat. It is unaffected by air at ordinary temperatures, but will, if sufficiently heated, burn with a white flame.

A MEMORIAL GIFT.

MESSRS Elkington and Co. have recently manufactured at their Birmingham establishment a very elaborate casket intended to contain an address to Mr. Alderman Walker, the late Mayor of Liverpool. The casket, designed by Mr. Williams, is a work of great importance and rare merit, both as regards its size and as a specimen of art metal work. At the base it measures about twenty-seven inches by twenty-one. The material is silver, "parcel" gilt, and enriched with very choicely-finished enamels. The necessity of including a model of the building in the memorial necessarily determined the general character of the design. As the model crowns it, the casket is arranged so as to resemble an architectual plateau, rising by successive stages to the flat, which supports the model of the Gallery. The base is enriched all round with groups of children, modelled from the famous designs of Fiamingo, and executed in repoussé, in oxidised silver. At each of the four corners is a mermaid, emblematic of the maritime character of Liverpool. In the centre of the front is a panel, bearing the arms of Liverpool, enamelled in their proper heraldic colours, and supported by winged figures, indicating the Arts and Sciences, and surmounted by the figure of the liver—the bird which forms the crest of Liverpool, and gives its name to the town. On one side of the base the arms of Mr. Walker are emblazoned on a shield in enamalled colours, on a panel; and at the opposite side the corresponding shield bears the monogram of Mr. Walker, combined with that of his wife, and surmounted by a mural crown. Above this highly enriched base—every part of which is covered with ornament—are two stages, or broad steps, plain and gilt. At the corners of these steps are statuettes of figures representing Europe, Asia, Africa, and America, indicating the world-wide trade of Liverpool; these are exquisitely carved in ivory. On the flat of the steps we have the inscription, which is as follows:—"Model of the Walker Art Gallery; scale 32 ft. to an inch. First stone laid by H.R.H. the Duke of Edinburgh, K.G., K.T., on 28th September, 1874. Opened by the Right Hon. the Earl of Derby, 8th September, 1877. This casket, containing an illuminated address, was presented by his fellow-townsmen to Andrew Barclay Walker, Esq., Mayor of Liverpool, in acknowledgment of his magnificent gift to the town of the Walker Art Gallery, on its being opened." The model of the building crowns the work, and stands out conspicuously on its broad gilt plateau. The sculpture which ornaments it—statues of Raffaelle and Michael Angelo, and an emblematic group, all of them by Mr. Warrington Wood—is executed in ivory, and this charming relief is given to the general mass of the silver model. Altogether the whole work is a triumph of skilful design and of ingenious execution. The ornamental silver enrichments are as perfect as art could make them, the ivory carvings are exquisite in their delicacy and grace, and the enamels challenge comparison with the best works of their kind.

VALUABLE EXPERIMENTS WITH SPIRALS.

THE influence of temperature on the regulating of watches is a subject of such vast importance to conscientious timers that too much attention cannot be bestowed thereon. Thanks to our Trade Journals, which foster an interchange of ideas and experiences between the most competent craftsmen of all countries, great progress has of late years been made, and without such opportunities our art would advance but slowly.

Practical experiments on spirals of different metals, approaching as near as possible in length, breadth, and thickness, were absolutely necessary to calculate accurately the changes of elasticity which affect the compensation balance. Mr. Grossman well-known as the author of the Prize Essay on the Lever Escapement, recently wrote to the *Journal Suisse d'Horlogerie* on the importance of obtaining some positive results from observation; and regretting his inability to make the experiments, from want of proper means to produce satisfactory trial spirals, he appealed to the Geneva watchmakers to undertake this honourable task for the benefit of our art. It was in answer to this call that Mons. C. A Paillard, in concert with his colleague Mons. Ch. Haas, made a series of experiments, the results of which were communicated to the local horological organ.

A good watch of 19 lig., with lever escapement, was employed for the trials—a timekeeper which had proved itself perfectly reliable for some years, and offered, therefore, the necessary regularity. It had been accurately regulated with an elbowed spiral of tempered and blued steel, from the temperature of +1° to +35° cent., and the results were repeatedly verified. Similar ferrules to the first were then prepared, and spirals of different metals adjusted, great care being taken to secure them.the exact length of the tempered steel spiral. It must be remarked that only such spirals as came perfect from the receptacle which served to keep them rolled were used for these experiments, and that they were nowise redressed.

The balance having been carefully put in equilibrium at the beginning, remained intact during every trial.

The results were as follows:—

	Dilatation for + 1°.	Variation in Rate for + 35°.
Spiral in hard platinum	0,0000090	advance 1m. 38s.
,, tempered steel	0,0000125	,, 0m. 0s.
,, non-tempered steel	0,0000125	retard 0m. 13s.
,, gold alloy	0,0000155	,, 1m. 56s.
,, silver 800-1000......	0,0000190	,, 4m. 9s.

These trials were repeated several times with almost identical results. Slight and inevitable variations must, of course, always be expected in regulating, but in this case the differences were scarcely a few seconds. Numerous observations were also made with other watches, with spirals of different alloys of gold, palladium, etc., and in all cases, except the minute differences above mentioned, the results have corresponded with the rate calculated from the dilatation of the alloys employed for each trial.

Mons. Paillard, says: "The lengthening of the spiral blade under the influence of an elevated temperature is not the principal cause of retard. it is more likely the result of a loss of elastic force, no do[illegible] due to a change in the molecular condition of the metal under the action of heat. It is also highly probable that this variation of elastic force is connected with the co-efficient of dilatation of the metal or alloy used, because each time the rate observed harmonised with the calculated one, based on the dilatation. There may be some metals which form an exception, as we could use alloyed spirals only. We have made some in copper, brass, &c., but were obliged to abandon a trial, because they were all too soft, and a sufficient consistence and elasticity to resist the deformations produced by the vibrations of the balance could not be obtained. Another factor in the changes of elastic force by temperature is the degree of hardness and temper, but to a very minute extent in comparison to dilatation. So, for instance, we find that the spiral of tempered steel gives an almost equal result with the non-tempered one, while the platinum spiral, which is the softest of all, causes an advance when heated. If we classified these spirals according to their degree of hardness (*i.e.*, resistance to deformation) they would come in the following order:—

Spiral in tempered steel.
,, gold alloy.
,, silver 0,800.
,, non-tempered steel.
,, platinum.

Mr. Grossmann suggested that it would be highly beneficial to arrive at the production of spirals which possessed the necessary properties for regulating, and required at the same time a less powerful compensation of the balance. We quite agree with him, as it is essential to avoid as much as possible molecular displacement, which is considerable in the act of compensation. We have also made some researches with a view of gaining information on the latter subject. Platinum presents some advantages in this respect, as it would permit the use of very moderate balances, but its density is such as to forbid its use, at least for watches. For this reason we have substituted the alloy of palladium, which enjoys about the same properties as the platinum, without the great weight of the latter. Thus we were enabled to make spirals sufficiently vigorous and entirely inoxidizable, which, however, still demand as strong a compensation as steel ones."

There are yet many questions in horology more or less obscure, which every one who takes an interest in the future of our art should assist in clearing up, and Mr. Paillard has set an example which is well worthy of imitation by the many able horologists in this country.

PENDULUM EXPERIMENTS.

PREPARATIONS are being made at the Champ de Mars, Paris, for executing Foucault's pendulum experiments on an enlarged scale. His apparatus was suspended in 1851 under the dome of the Pantheon. It was in operation for a long time, and only removed when the building was transformed into a church after the *coup d'état* in 1852. The weight of the pendulum will be 300 kilogrammes, and it will oscillate at the end of an iron wire from 65 to 70 metres long. Thus a special construction will be required for its suspension. The pendulum will be suspended above a grooved pipe which will move freely on an axis in its centre. In oscillating it will displace this pipe which will remain, like the pendulum itself, fixed in space in reference to the constellations. Underneath it will be arranged a large terrestrial globe, from 25 to 30 metres in diameter. This globe resting on the ground, will necessarily follow with the spectators the movement of the earth. The pipe, on the contrary, supported by a pivot at the extremity of the axis will carry large indexes, which will appear to be displaced with it. The globe, which will represent the earth, having a considerable volume, the movement of these indexes will be visible; it will render tangible in some degree, to the least attentive, the rotation of the planet on its axis.

Gold Crystals from the Ural.—In the *Mineralogische Mittheilungen*, Herr Helmbacker describes an interesting collection of crystals of gold brought from the washings of Inzelokylog, near Sysertsk, in the Ural. Some of these crystals were pure golden yellow, while others had a brownish colour almost like bronze. As the specific gravity of both kinds of gold was found to be the same, the cause of the colour cannot be attributed to difference in the substance, but rather to a thin coating of simonite which caused the bronze yellow colour. From the density the percentage of gold was found by Archimedean rule of alligation to be about 77 per cent.

ANTIQUE JEWELLERY AND ITS REVIVAL.

By Alessandro Castellani.

Translated from "Kunst und Gewerbe."

THE production of jewellery closely imitating the ornaments in gold and precious stones of earlier ages, is now a firmly established industry in Rome. The imitations are so faithful, that each article at once points out the period and nationality of its model.

Italy was in the Early and Middle Ages, the most important centre of European civilisation and the home of the arts. It is, therefore, natural that we should have selected the productions of the Etruscans, Greeks, and Romans as our models. Before proceeding further we wish to say a few words about the Etruscans, to whom we are indebted for the earliest relics of our art. The best informed ethnologists have up to the present time been unable to lift the veil which covers the origin of this people. All we know for certain is, that their cradle was the same as that of other nations, which is proved by the resemblance of their monuments to those found in other parts of the world.

The Remains of Cumæ, the Etruscan Tombs, the Ruins of Nineveh, the Indian Temples, the Pyramids, and other antique Egyptian buildings, all have much in common as regards form, style, and manner of construction, which leads us to the conclusion that these different races have one origin, or are, at least, closely related. The most striking proof of the truth of this assertion exists in the well-preserved gold ornaments which have of late years been discovered in the tombs of Etruria and Greece. There is a great resemblance in form and workmanship between these ornaments—the decorations of the old Indian idols, the valuables discovered in Nineveh by the great archæologist Mr. Layard, and those Egyptian treasures excavated by A. Mariette, which were so much admired by the visitors of the Egyptian section at the International Exhibition of London. All authorities of the present day agree that the East gave birth to the different nations which spread over Europe.

Our present task, however, is not to speculate on the different causes and accidents which may have occasioned these people to scatter and seek fresh homes in the West, but simply to demonstrate that the objects of ornament produced by the earliest of them, if not altogether the same, have at least a decided resemblance. From this fact we may conclude that they possessed a number of chemical and mechanical processes in common, which are unknown to us.

The most beautiful antique jewellery preserved to our time, both as regards form and workmanship, is that made on Italian soil. Among the races inhabiting Italy in early times were, as we have already stated, the Etruscans, whose history is wrapt in darkness. The historian Miculi (Vol. I., chap. 7) says, "The origin of the Etruscans was very uncertain even in olden times." But their system of religion, of which we have some particulars, their ornaments and household chattels, in fact, everything belonging to them, and which has been preserved to our day, clearly shows that they immigrated to Italy from the East. They are also sure signs that the educated Etruscans cultivated the arts—a pursuit which secures wealth and power to nations. The Greeks, jealous of Rome, called the first Italians barbarians, and pretended that the mythological heroes Hercules and Æneas had introduced Greek civilisation into Italy. They asserted that the history and art of the first inhabitants of our peninsula were doomed to perish so as to establish the greatness of Rome and the Latin race. The traditions of these people were, therefore, entirely lost, and their tombs alone, discovered and excavated from time to time, have kept them slightly in remembrance, and show the present generation of Italians the remarkable traces of their forgotten forefathers. Some of the remaining relics display skill and taste of the highest order, inimitable at present; and we are obliged to admit that the arts were in a flourishing condition in those periods. We must not forget to mention that the Greek colonists in Southern Italy, descendants of a race which reached nearer perfection in the arts than any other, left us some ornaments which are nowise inferior to those of the Etruscans. An extended commerce brought a degree of wealth and luxury with it, which they never enjoyed in their native country, and provided them in abundance with the precious metal which they so well knew how to manipulate.

Although more conquerors and lawgivers than artists, the Romans learnt in time to appreciate the tasteful works in gold and jewels of the civilised neighbour they oppressed; and if their productions cannot vie with those of the Etruscans and Greeks, they have still left us some models well worthy of imitation. The barbarism which ruled Europe for several centuries after the fall of the Roman Empire, destroyed the traditions of the art, and made it difficult to assign the correct period to the different articles of use and ornament belonging to antiquity. Recent researches permit us, however, to state that the goldsmith's art was already on the decline in the reign of Augustus. It had attained a high standard of excellence in Rome under the Etruscans and Greeks, but the growth of imperial power was fatal to it. Such has been the case with the arts at all times: they spring forth with the freedom of nations, and begin to wither as soon as liberty suffers or dies out. Works of the Greco-Roman period which are vastly inferior to anything left by the two nations previously mentioned, have been brought to light by the excavations of Pompeii, so that the decadence of our art must have already begun at this epoch.

If a body perishes, it is not only one of its elements that is doomed, but every one that helps to constitute it. So the Roman Empire, falling from one stage of weakness to another, caused the ruin of every class of society and of every branch of art. We can easily distinguish all the works from the third to the sixth century; a time during which rings and bracelets and other objects of ornament were made of great weight and solid form, quantity of material being preferred to artistic workmanship. For this reason we possess comparatively few of these ornaments; they were anxiously sought for by the various barbarian races which invaded and plundered Italy at least a hundred, times and then returned to their mountain and forest homes laden with valuable booty. The first Christians, mostly poor people, which were taught to despise all outward show, had neither the wish nor the means to use costly vessels at their religious ceremonies. Their altars were decorated with terra-cotta and bronzes; and the bread used at holy communion and funeral obsequies was kept in copper cases. The few gold and silver ornaments found in the Roman Catacombs, although similar in form to those of earlier periods, are so inferior in artistic value that they can only be compared to the roughest works of the earliest times. The medallions, rings, and fibulae, which were worn as signs of recognition in times of persecution and danger, were embellished with the symbols of Christianity in the most ordinary manner.

At Byzantium, the new capital of the Empire, which from a Roman gradually became a Greco-Oriental one, the arts underwent a material change. Jewellery lost its antique Italo-Greek type, and assumed the entirely different character of the Arabian and Oriental school; in short, everything became subject to Byzantine taste. Enamels, mosaics, precious stones, pearls, and engraving, all were put together with Asiatic luxury after the characteristic style of the Byzantine school. Still some of the architectural forms of the Greeks were preserved in the general application of ornaments, which help to blend antique and modern art in the period of Renaissance. Byzantine artists, representing, although in half barbarian style, Christian symbols and figures, were obliged to flee from the image-breaking emperors' and settled in Venice. Here they spread the knowledge of their art, which, when adopted by the Italians, gradually drifted into the Italo-Lombardic style. This latter lasted till the time of Cimabue. Many of the productions of this period, such as altars and sacred vessels, still exist in the churches of Upper Italy. After the consternation caused by the prediction of the end of the world, in consequence of a false interpretation of the Scriptures, had subsided, the European nations returned with new vigour to their ordinary occupations, and among others to the study of those arts which help to adorn our earthly existence.

The fine arts were again cultivated, and if they did not attain a state of perfection, their future prospects became at least brighter. Ornaments and vessels for church service had their origin in convents, where most of them were at first manufactured under the special supervision of the priesthood. Byzantine art, with its distinct forms of antique architecture, is represented by the altars of Cologne and Aix, and many other church relics of this epoch. A capital treatise on the art of decoration and the manipulation of the precious metals, was written by Monk Theophilus some years later. About this time the goldsmith's art had made great progress and freed itself more and more of the rough taste with which it was practised during the age of barbarism. In the fifteenth century a new and better Italian school began, creating those *chef-d'œuvres* of our art which remain unsurpassed to the present day. At the head of this school are: Maso Finiguerra, Caradosso, and Benvenuto Cellini. It is not certain whether the Italian masters of the goldsmith's art in the fifteenth century had lost all the traditions of the old school, or if they despised them, and sought to create a new direction for this art—one more in harmony with the forms of the sister arts, which began to revive at this time. As a confirmation of the latter opinion, to which we incline, we quote the following anecdote from the Life of Benvenuto Cellini: He tells us that Pope Paul III. showed him one day a gold Etruscan necklet of exquisite workmanship, which had accidently been discovered in its hiding place in the earth. He examined it very closely and exclaimed, "It is better not to imitate these Etruscans, as we should only be their humble servants; let us rather strike out a new path, which will at least have the merit of originality." These artists invented and practised methods which differed entirely from those of their old masters. They made use of graver and chisel; of enamel, nielli, cast ornaments, and precious stones; and their best works are those in which these costly materials are combined by the free and original idea of the artist, altogether independent of antique models. With the decadence of Painting, Sculpture, and Architecture in the time of Michael Angelo, the goldsmith's art also declined. In the seventeenth century the decay was almost complete, and every remnant of good taste was lost under the Spanish and Austrian rule over Italy. It reached its lowest stage towards the end of the last century, and up to the present time our art has, with few exceptions, been deprived of its artistic character, to become the slave of fashion and an article of mercantile speculation.

A few attempts to imitate antique jewellery were made at Naples in the first year of this century. The honour of first reviving our art belongs to the jeweller Sarno; and thanks to the assistance and patronage of Neapolitan archæologists, and a great demand from abroad, it remained in a prosperous condition for a few years; but we cannot assign the real cause of its gradual decrease and its final collapse. Some years later, the artists of this school employed their knowledge in producing counterfeits of the gold ornaments found in Pompeii and Herculaneum. They reached such perfection in this criminal branch of industry, that Naples became famous for forged antiquities. With artificial colours, acids, and gold solutions, they attained their object so well, that any one deficient of great experience in jewellery and knowledge of archæology was unable to decide whether they were really antique or not.

Signor Castellani, the elder, opened an *atélier* in Rome in 1814, for the imitation of French and English ornaments; and it was not long before he succeeded in surpassing them in beauty. This field of labour became, however, too small for him, and in 1826 he applied himself to chemistry with a view of finding some new process for his art, with the assistance of that science. In the same year he was enabled to lecture at the "Academy of the Lincei" in Rome, on chemical processes for the colouring of gold, in which he explained the application of the electric and similar gilding processes. Many scientific reviews spoke highly of his discoveries, among which we shall only mention the *Rèvue de Genève*, because it hails from the home of the learned De la Rive, one of the discoverers of the modern galvanoplastic process. By not further prosecuting his inventions the elder Castellani showed what little value he set on outward appearance, which, although it deceives most people, is unable to hide faulty designs and bad taste from the critical eye of the artist.

About this time mother earth returned us some of the wonders and treasures of Etruria, which had been hidden in her lap for so many centuries. Whoever saw them was astonished at the magnificent jewellery found in the old tombs of that mysterious country. Signor Castellani first conceived the idea of copying them. Some admirers of antique art encouraged him in his enterprise; but the only assistance he enjoyed was that of the Duke Michel-Angelo Caetani, who instructed him almost daily, and whom we may call a perfect master in the art of drawing. Years of continued researches and labour enabled Signor Castellani to reproduce the old Italian and Greek ornaments. For this purpose he selected the finest models only, and to his copies he gave the name of "Italian archæological jewellery."

On the discovery of the tomb which now bears the name of Regulini-Galassi, we were invited to examine the beautiful gold works excavated there, and which went afterwards to enrich the Etruscan museum at the Vatican. Such a discovery was of great importance to our art as a means of perfecting our knowledge of old Etruscan jewellery, and facilitating our search after the old methods employed in the working of the precious metals. We also derived great benefit from the later discoveries in Toscanella by Secondaiano Campanari, and in Caere by the Marquis Campana. In all our researches we had the advantage of Duke Caetani's valuable assistance.

(*To be continued.*)

Prices Current for Gold and Silver—Value Given for Old Gold and Silver by Assay. Fine Gold, 84s. per oz. Fine Silver, 4s. 8d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. 3d. per oz. Standard Silver, 4s. 8d. to 4s. 10d. (variable).

A Robber of Museums.—In the October number of our journal we mentioned the robbery of some valuable stones perpetrated at the Leyden Museum during a visit of the Emperor of Brazil. The Dutch paper *Vaderland* says that the robber is now in safe custody. He turns out to be the German Baron Clamor von Freytag, the same individual who sold at Brussels some of the articles stolen from the British Museum. He was arrested in the Province of Hanover, and will be tried at Brunswick. The Dutch Government has demanded his extradition.

Mr. Riker, of New York, is producing some elegant works of art by an ingenious process of inlaying various coloured gold on a bright flat surface. Lockets, band rings, shanks of seal rings, and various other objects (of which Mr. Riker makes a speciality), enriched with artistic designs of the most delicate shading, are exceedingly attractive.

THE

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A MONTHLY TRADE JOURNAL,

Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at MILNERS' BUILDINGS, MOORGATE STREET (OPPOSITE MOORGATE STREET STATION), LONDON, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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TO A BOY WITH A WATCH.

WRITTEN FOR A FRIEND, BY THOMAS MOORE.

Is it not sweet, belovèd youth,
  To rove through Erudition's bowers,
And cull the golden fruits of Truth,
  And gather Fancy's brilliant flowers?

And is it not more sweet than this
  To feel thy parents' hearts approving,
And pay them back in sums of bliss
  The dear, the endless debt of loving?

It must be so to thee, my youth;
  With this idea toil is lighter;
This sweetens all the fruits of Truth,
  And makes the flowers of Fancy brighter.

The little gift we send thee, boy,
  May sometimes teach thy soul to ponder,
If indolence or syren joy
  Should ever tempt that soul to wander.

'Twill tell thee that the wingèd day
  Can ne'er be chain'd by man's endeavour;
That life and time shall fade away,
  While heaven and virtue bloom for ever!

WEIGHT OF GOLD COINS.—The sovereign of England contains 113 grains of pure metal; the new doubloon of Spain, and the half-eagle of the United States, 160 grains each; the gold lion of the Netherlands and the double ounce of Sicily, 117 grains each; and the 25 franc piece of France, 112 grains.

A WATCH about the size of an egg, said to be made by a Russian peasant, is now exhibited at St. Petersburg. Within it is represented the tomb of Christ, with a stone at the entrance, and the sentinels on duty. While a spectator is admiring this curious piece of mechanism, the stone is suddenly removed, the sentinels drop, the angels appear, the women enter the sepulchre, and the same chant is heard which is performed at the Greek Church at eve.

TRADE RECIPES, &c.

GILDING BRASS BY DIPPING IN ACIDS.—Distilled water, 17 pints; pyrophosphate of soda, 28 oz.; hydrocyanic acid of ⅕ prussic acid, ⅓ of an oz.; crystallised perchloride of gold, ⅔ oz. The pyrophoshate is dissolved in 16 pints of water, heated, filtered, and cooled. The filtered solution of the gold chloride is added, and then the hydrocyanic acid, when the whole is raised nearly to the boiling point for use. Before entering the bath the articles should be passed through a solution of water 2⅕ gallons; nitrate of binoxide of mercury, ⅓ oz.; sulphuric acid, ⅔ oz. Before dipping, the brass articles should be soaked in a solution of caustic potash dissolved in 10 times its weight of water.

TO REMOVE RUST FROM STEEL.—Cover the metal with sweet oil, well rubbed in; forty-eight hours after, rub with finely pulverised unslaked lime.

THE Turks glue diamonds and other jewels to their metal settings with a mixture made as follows:—Dissolve five or six bits of gum mastic, each the size of a large pea, in as much spirits of wine as will suffice to render it liquid. In another vessel dissolve in brandy as much isinglass, previously softened in water, as will make a 2 oz. phial of strong glue, adding two small bits of gum ammoniac, which must be rubbed until dissolved. Then mix the whole with heat. Keep in a phial closely stopped. When it is to be used set the phial in boiling water. This cement perfectly resists moisture, and it is said to be able to unite effectively two surfaces of polished steel.

BLUING IRON AND STEEL BY BOILING.—If iron or steel articles be boiled in the following mixture, they will take a fine blue tint: Dissolve 4 ozs. hyposulphite of soda in 1½ pints of water, and then add a solution of 1 oz. acetate of lead in 1 oz. of water.

GOLD AND SILVER BRONZE POWDERS.—A gold bronze powder is made by melting together in a crucible over a clear fire equal parts of sulphur and white oxide of tin. Stir until they become a yellow flaky powder. Silver bronze is made by melting together 2 lbs. each of tin and bismuth, and adding 1 lb. of quicksilver. Pound all together into a powder.

COLOUR OF SOVEREIGNS.—It has often been noticed that the colour of the Sydney sovereigns, as well as that of some of our English coinage, is of a very pale yellow. This arises from the presence of silver universal in all Australian gold. This is not so apparent in coins of more recent make, as a process has been introduced whereby the silver can be extracted, and by the addition of an alloy of copper, a more ruddy appearance, as well as a greater hardness, is produced. The French exchange brokers used always to give a trifle more for these yellow sovereigns than for others. *Verbum sap.* It may be useful also to know that a cubic inch of gold will, at the Government price of £3 17s. 10½d. per oz., be worth £42.

KING ALFONSO has ordered at Paris a casket by way of a betrothal present to his future wife, the Princess Mercedes. It is in lapis-lazuli, mounted on four lions' claws, 16 inches high and 30 square, ornamented with garlands of golden roses, which are miracles of delicate workmanship. The hues of the flowers are all faithfully presented. The key is a golden rose full bloom. The interior of the casket is lapis-lazuli, studded with tiny nails, diamond-headed. The casket is intended to hold the lover's love letters, but it goes to the Princess in the first place with but one note and a necklace of eight rows of pearls.

RECOVERY OF PLATINUM.—Mons. E. Duvillier recommend the following method of reducing the platinum from the chloroplatinate of potassium:—100 grammes of the chloroplatinate, 50 grammes of dry formiate of soda, 50 c. centimetres of soda at 30° B, boil in about 1 litre of water.

PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

4661. Frank Wirth, of the firm of Wirth and Company, Patent Solicitors, at Frankfort-on-the-Maine, in the Empire of Germany, for an invention of "Improvements in ear-rings."—A communication from Rudolf Speltz, Jeweller, a person resident at Frankfort-on-the-Maine, in the Empire of Germany.—Dated 8th December, 1877.

4904. Alexander Melville Clark, of 53, Chancery Lane, in the County of Middlesex, Patent Agent, for an invention of "An improved universal timepiece or geographical clock."—A communication to him from abroad by William Asto Cates, of Union, in the county of Union, and State of Oregon, United States of America.—Dated 27th December, 1877.

Notices to Proceed.

2837. George Henry Bricknell, of Birmingham, in the county of Warwick, Jeweller, has given notice in respect of the invention of "Improvements in fastenings for buttons, shirt studs, solitaires, and other articles of jewellery and dress."

2928. John Frederick Bennet, of 5, Southampton Buildings, Holborn, in the county of Middlesex, has given notice in respect of the invention of "Improvements in studs or solitaires, applicable for other fastening purposes."

3139. John Muirhead, junior, and Alexander Muirhead, both of 29, Regency Street, in the city of Westminster, have given notice in respect of the invention of "Improvements in the receiving instruments of electric-telegraphs, and in recorders for other uses."

3187. Paul Jablochkoff, of Paris (France), engineer, has given notice in respect of the invention of "A magneto-dynamo-electric machine."

Grants of Provisional Protection for Six months.

4124. To John Clayton Mewburn, of 169, Fleet Street, in the city of London, Patent Agent and Consulting Engineer, for the invention of "Improvements in clocks."—A communication to him from abroad by Charles Delagrave and Louis Maximilien Grignon, both of Paris, France.

4126. To Henry Edward Newton, of the Office for Patents, 66, Chancery Lane, in the county of Middlesex, Civil Engineer, for the invention of "Improvements in the constructiou of buttons and studs."—A communication to him from abroad by Henri Burtey, of Paris, in the republic of France.

3302.—To Edward Fletcher, of Salford, in the county of Lancaster, Engineer, for the invention of "Improvements in watches."

4281. To William Hair Haseler, of Birmingham, in the County of Warwick, Goldsmith and Jeweller, for the invention of "Improvements in magnetic or mariner's compasses and in ornamenting the said compasses."

4551. To Alexander Charles Fraser, of 449, Strand, in the county of Middlesex, Manager to Messieurs Elliott, of the same place, Opticians, for the invention of "Improvements in magnetic compasses."

4661. To Frank Wirth, of the firm of Wirth and Company, Patent Solicitors, at Frankfort-on-the-Maine, in the Empire of Germany, for the invention of "Improvements in ear-rings."—A communication from Rudolph Speltz, Jeweller, a person resident at Frankfort-on-the-Maine, in the Empire of Germany.

4500. To Gustave Adolphe Schoth, of the Euston Road, in the county of Middlesex, for the invention of "Improvements in electric piles applicable to medical, telegraphic, and other purposes."

4608. To Matthew Townsend Sale, of Chatham, in the county of Kent, Captain Royal Engineers, for the invention of "Improvements in apparatus for taking up, sending, and repeating voice sounds by electricity to and from distant stations or places."

4799. To James Brockie, of Canonbury, in the county of Middlesex, for the invention of "New or improved apparatus for synchronising clocks."

Patents granted in British Colonies and Dependencies.

Canada.

7724. Charles S. Mosely, of Elgin, Ill., U.S., for "an improvement in watch movements." (Perfectionnement dans les mouvements des montres.)—15 years.—Dated 9th August, 1877.

Certificates of Addition.

116,902. Piat, for "A portable and oscillating furnace for smelting copper, gold, silver, &c."—Dated 17th February, 1877.

Patents Granted in Foreign States.

Belgium.

43,549. W. W. Le Grande, for "Improvements in tell-tales for night-watches."—Dated 16th November, 1877.

43,557. A. A. Favarger, for "Improvements in magneto or dynamo-electric machines."—Dated 17th November, 1877.

France.

106,372. Edard, for "Electro-magnetic apparatus."—Dated 19th March, 1877.

112,154. Piat, for "A portable oscillating furnace for smelting copper, gold, silver," &c.—Dated 23rd March, 1877.

116,790. Francois, for "An alarum for winding up clocks,"—Dated 30th January, 1877.

116,800. Pouplier, for "A decimal pendulum balance."—Dated 31st January, 1877.

116,841. Cartier, for "An apparatus for moulding enamel and incrusting it in jewellery."—Dated 3rd February, 1877.

116,858. Hollebeke and Dubois, for "Improvements in the manufacture of studs."—Dated 3rd February, 1877.

116,889. Finot, for "Improvements in tools for watchmakers."—Dated 6th February, 1877.

116,915. Brocot, of Paris, for "Improvements in the spring-counter suspension for regulating clocks."—Dated 7th February, 1877.

116,990. Japy and Millot, for "Clock-work for repeating quarters and hours, applicable to travelling and other clocks."—Dated 10th February, 1877.

117,010. Popp, Resch, and Mayrhofer, for "Pneumatic clocks."—Dated 10th February, 1877.

117,023. Henard and Lasnier, for "A cosmographic clock."—Dated 12th February, 1877.

117,032. Perret, for "A machine for regulating clocks."—Dated 14th February, 1877.

117,204. Rioult, for "Improvements in jewellery."—Dated 24th February, 1877.

117,250. Contal and Touya, of Tarbes, for "A balanced clock with wear and tear compensation."—Dated 19th December, 1876.

117,908. Picard, of Paris, for "A machine for repairing the potances of watches, and their rising angles."—Dated 5th April, 1877.

118,023. Oeschger, Mesdach and Co., for "Separating metals, and especially copper alloyed with gold and silver, by electricity."—Dated 12th April, 1877.

German Empire.

2078. Wirth & Co., of Frankfort-on-the-Maine, for N. Salmon and A Delavière, of Paris, for "Studs."—Dated 10th November, 1877.

3167. E. A. Brydges and Co., of Berlin, for W. Ley, of London, for "An arrangement of the hands in time-pieces."—Dated 16th November, 1877.

7. E. Schönfeld, of Hanau, for "Fastenings for bracelets, necklaces, and rings."—Dated 4th July, 1877.

United States of America.

194,744. J. Thomson, of Rochester, N.Y., for "Watch-escapements."—Application filed 29th March, 1877.

194,837. J. H. Myers, of Troy, N.Y., for "Cuff-fasteners."—Application filed, 24th July, 1877.

194,904. George Havell, of Newark, N.J., for "Watch-keys."—Application filed 9th August, 1877.

194,915. Henry C. Jacot, of St. Louis, Mo., for "Regulating attachments to pendulum-balls."—Application filed 27th July, 1877.

195,004. Julius Hackenberg, of New York, assignor to himself and Chas. H. Graef, of Edgewater, N.Y., for "Bracelets."—Application filed 30th April, 1877.

195,028. William F. Lewis, of Waterbury, Conn., assignor to the Waterbury Clock, Company, of the same place, for "Clock-cases."—Application filed 30th June, 1877.

195,268. Edwin H. Flint, of Cincinnati, Ohio, for "Mainspring attachments for watch-barrels."—Application filed 11th June, 1877.

Applications for Letters Patent (with Provisional Protection).

3732. G. Riedel, of Havelberg, for "A thermometrical apparatus for winding up large clocks."—Dated 30th November, 1877.

Patents which have become Void.

3280. Thomas Telford Macneill, of 1, Warwick Street, Charing Cross in the county of Middlesex, for an invention of "Improvements in barometers."—Dated 15th December, 1870.

Patents Sealed.

2467. Peter Jensen, of Chancery Lane, London, for an invention of "A new or improved pneumatic precision clock with lever escapement and worked hydro-pneumatically."—A communication to him from abroad by Carl Albert Mayrhofer, of Vienna, Austria, Engineer.—Dated 26th June, 1877.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Baddeley, Jno. Dodwell, Geach-street, Birmingham, jeweller, Nov. 29. At E. Jacques', sol., 40, Cherry-street, Birmingham, Dec. 14 at 3.

Hughes, Price Robert, 26, Chapel-street, Carnarvon, jeweller, Nov. 28. At Queen's Hotel, Birmingham, Dec. 12 at 12. J. B Allanson, sol., Carnarvon.

Braham, Lewis, 142, Southampton-row, Holborn, optician, Nov. 29. At Guildhall Tavern, Gresham-street, Dec. 15 at 4.

Rogers, John Alfred, 378, Oxford-street, London, and 115, Lionel-street, Birmingham, builder's ironmonger and jeweller's factor, Dec. 3. At Great Western Hotel, Birmingham, Dec. 19 at 2. Ryland, Martineau and Carslake, sols., Birmingham.

Ascoli, Augustus, 4, Commercial-road, Wood Green, watchmaker and umbrella manufacturer. Dec. 20. At T. A. Romer's, sol., 3, Furnival's-inn, Jan. 8 at 3.

Melen, Henry, trading as H. Melen & Co., Studley, and Pershore-street, Birmingham, brick and electro-plate manufacturer. Dec. 17. At W. Fallows, sol., 12, Cherry-street, Birmingham. Jan. 1 at 3.

Morath (and not **Moratti**, as erroneously printed in last Gazette), Thomas, 73, Hammersmith-road, and Denmark-place, Portland-road, South Norwood, jeweller. Dec. 14. At C. Thorp's, sol., 19, Cranbourn-street, Leicester-square. Dec. 31 at 12.

Turpin, Robert Thompson, 33, Front-street, Tynemouth, and Cromwell-street, Newcastle, watchmaker. Dec. 18. At Keenlyside & Forster's, sols., Newcastle. Jan. 11 at 11.

Ward, William Henry Hall, Darley-street, Bradford, jeweller. Dec. 19. At Berry & Robinson's, sols., Bradford. Jan. 4 at 11.

Dividends.

Douglas, Jas. 96, Argyle-street, Glasgow, goldsmith, &c. 1st J. Miller's 71, Queen-street, Glasgow, Dec. 10.

Ray, Eliza Sarah and Edwin Stewart Harrison (Liq.), 35, Great Castle-street, Regent-street, jewellers. Div. 2/6; Webb and Norman, 86, Newman-street, Oxford-street.

The Jeweler's Circular and Horological Review.

Established 1869.

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THE
WATCHMAKER
JEWELLER.
AND
SILVERSMITH'S
TRADE
JOURNAL.
W.H. TILBY

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ARTIFICIAL PRODUCTION OF CORUNDUM, RUBY, AND VARIOUS CRYSTALLISED SILICATES.

By MM. E. Fremy and Feil.

THE following is a translation of a valuable paper read before the French Academy of Sciences, a report of which appeared in the December number of the "Comptes Rendus de l'Académie des Sciences":—Synthetic mineralogy (that is to say, the artificial production of minerals) presents, in a acientific point of view, an interest which every one can understand; for it throws the greatest light upon the mode in which minerals are formed, and permits us to solve certain questions relative to their composition which chemical analysis often leaves undecided. In fact, a mineral which appears quite pure generally contains foreign substances interposed which existed in the medium that formed it; analysis is then powerless to determine the real composition of the mineral, while a synthetic reproduction enables us to distinguish the constituent elements from those which are merely accidental. A great number of minerals have been artificially produced in the dry way, in the wet way, and by M. Becquerel's ingenious methods; and synthetic reproduction is daily receiving some fresh extension, as is proved by the recent discoveries of M. Hautefeuille.

Corundum has, perhaps, more than any other mineral exercised the sagacity of chemists. The excellent investigations on the different modes of crystallisation of alumina, which have been published by Ebelmen, de Senarmont, and since by MM. H. Sainte-Claire Deville and Caron, by M. Gaudin, and by M. Debray, are well known to every man of science. Even after these remarkable researches, however, we may still interest the Academy by making known the processes we employ for the production of differently coloured and crystallised alumina (ruby and sapphire) in masses sufficiently large to be used in horology and to be cut by the lapidary. It will probably be possible to apply the methods we are about to describe to the artificial production of other minerals.

Wishing to approximate as nearly as possible to the natural conditions which have probably determined the formation of corundum, ruby, and sapphire, we have borrowed from industry its most energetic heat-producing appliances, which permit an elevated temperature to be produced and maintained for a long time, and considerable masses to be operated on; indeed, we have often acted on 20 or 30 kilogrammes of material, which we kept heated uninterruptedly for twenty days.

It was in the oven of Feil's works that we conducted the experiments which required the highest temperature. When our trials demanded prolonged calcination, we had recourse to a glass-furnace which was generally placed at our disposal by the company of Saint Gobain. In this case our essays were directed by an eminent chemist, M. Henrivaux, whose intelligent supervision secured their success. The following is the method which permitted us to produce the largest quantity of crystallised alumina :—

We commence by forming a fusible aluminate, and then heat it to bright redness with a siliceous substance. In this case the alumina is slowly separated from its saline combination in presence of a flux, and crystallises. We attribute the crystallisation of the alumina to various causes—either the volatilisation of the base with which the alumina is united, or the reduction of this base by the gases of the furnace, or the formation of a fusible silicate which, by the combination of its silica with the base, isolates the alumina, or, finally, a phenomenon of liquidation which produces a very fusible silicate and some hardly fusible alumina. All these cases presented themselves in our essays; but the displacement of alumina by silica appears to us the surest process for effecting its crystallisation. Several fusible aluminates lend themselves to these different kinds of decompositions, that which, up to the present, has given us the neatest results is the aluminate of lead. When a mixture of equal weight of alumina and minium is placed in a crucible of fire-clay, and calcined at a bright red heat for a sufficient time, two different layers are found in the crucible after cooling; the one is vitreous, and formed chiefly of silicate of lead; the other is crystalline, often presenting geodes filled with beautiful crystals of alumina. In this operation the sides of the crucible act by the silica which they contain. They are always made thinner, and often perforated, by the actions of the lead-oxide; therefore, to avoid loss of the product, we usually conduct the operation in a double crucible.

The experiment just described gives white crystals of corundum; when we would obtain crystals presenting the rose colour of the ruby, we add from two to three per cent. of bichromate of potass to the mixture of alumina and minium. The blue colouration of sapphire is produced by employing a small quantity of oxide of cobalt mixed with a trace of bichromate of potass. The ruby crystals thus obtained are ordinarily coated with silicate of lead, which we remove in various ways—either by the action of fused oxide of lead, or by fluorhydric acid, or by potass in fusion, or by prolonged calcination in hydrogen, and afterwards by the action of alkalies and acids; but in certain cases we find in the geodes some nearly pure crystals, which then exhibit all the characters of the natural corundums and rubies—possessing their composition, adamantine brilliance, hardness, specific gravity, and crystalline form. Our rubies, in fact, scratch quartz and topaz: their specific gravity is 4·0—4·1. They lose, like natural rubies, their rose-colour when strongly heated, and resume it on cooling. Submitted to lapidaries, they have been found as hard as, and often harder than, natural ones. They rapidly wear away the best grindstone of hardened steel. M. Tannettaz has kindly submitted our rubies to crystallographic observations: with the Amici microscope they present a black cross in their interior, and coloured rings upon the margins. The crystals which we have had cut, and now exhibit to the Academy, have not yet the brilliance demanded by commerce, because they did not present to the lapidary faces favourable for cleavage and cutting; but here are some crystalline masses weighing several kilogrammes, amongst which we shall doubtless find some that can be easily cut.

We will now describe the method which has enabled us to produce the fine specimens of crystallised silicates which we lay before the Academy. The experiments about to be described are connected with the preceding; for they have frequently given us crystals of corundum together with crystallised silicates. It was by means of fluorides that we produced the crystallised bodies of which we have still to speak. In carrying out these researches we have had the opportunity of appreciating all the accuracy of the observations of M. Daubrée, who first demonstrated the important part played by fluorine as a mineraliser, in the formation of mineral beds and of silicates. Those views are confirmed anew by our experiments. Guided by the classic writings of M. Henri Sainte-Claire Deville, we have ascertained that, of all the mineralisers, perhaps the most active is the fluoride of aluminium. Submitting a mixture of equal weights of silicate fluoride of aluminium to a red heat during several hours, we verified that by the mutual reaction of the two substances fluoride of silicium is liberated, and a crystallised body is obtained which appears to be kyanite—that is, silicate of alumina. According to the determinations of M. Jannettaz, this body occurs in doubly refracting acicular crystals, which extinguish light obliquely with respect to their edges. Doubtless they belong to one of the oblique systems—the oblique prism with rhombic base, or the doubly oblique prism. These crystals give the following composition :—

Silica	47·65
Alumina	51·85
Loss	0·50

This comes near to the composition of natural kyanite.

The action of fluoride of aluminium on boric acid gave a crystallised borate of alumina which corresponds to kyanite. We are at present carrying out a series of trials in which fluoride of aluminium will act upon other mineral acids. The important fact of the volatility of the fluoride of aluminium, discovered by M. Henri Saint-Claire Deville, enables us readily to explain the remaining experiments. When a mixture of equal weights of alumina and fluoride of barium, into which has been introduced two or three per cent. of bichromate of potass, is heated to and maintained at a very high temperature during a long time, a crystallised mass is obtained, the study of which is of the greatest importance. If the calcination has been effected in a crucible covered with another (which serves in some sort as a condenser), two sorts of crystals are found in the crucibles: the one sort are long colourless prisms, often several centimetres in length, and presenting the aspect of the silvery flowers of antimony; the others are ruby crystals, remarkable for the regularity of their forms and beautiful rose-colour. The long prismatic colourless crystals are formed by a double silicate of baryta and alumina, which present the composition :—

Silica	34·32
Baryta	35·04
Alumina	30·37

In our essays this double silicate often crystallised in rather short, hard, and transparent clinorhombic prisms, which M. Terreil has ascertained have the same composition as the long and hollow prismatic needles. M. Jannettaz has proved that the long prisms are often constituted by four plates with parallel faces, forming the faces of a hollow prism. These plates are very thin: under the microscope they extinguish light, or, rather, they let darkness persist between two Nicols, parallel to their mutual intersections; the plane of the optic axes is parallel to these intersections; they cut one another at angles of 60° 42′ and 119° 18′.

There is, therefore, produced in this curious reaction corundum and a crystallised double silicate. These two crystalline substances result from the following transformations: In the calcination of the mixture of alumina and fluoride of barium there are evidently formed fluoride of aluminium and baryta. The fluoride of aluminium, once produced, must have acted in two different ways. Decomposed by the gases from the hearth, it formed fluorhydric acid and corundum, which crystallised under the influence of the vapours. Acting besides upon the silica of the crucible, it gave rise to silicate of alumina, which, combining with the baryta, produced the fine crystals of double silicate of alumina and baryta which we exhibit to the Academy. Such, in our opinion, is the theory of the reaction.

Permit us now to dwell on the conditions which have determined the crystallisations of the two substances, corundum and the double silicate. Looking at the specimens we here exhibit, and which present such well-defined crystals, one is struck with the place which they occupy in the crucibles: they seem to have been volatilised; and yet we have ascertained, by exposing them to the highest temperatures of our furnaces, that they are absolutely fixed. It is because the fluorides are not merely powerful mineralisers, they are also compounds which, as was formerly said, give wings to the least volatile substances. Do we not recollect, indeed, that remarkable formation of orthose felspar produced artifically and found in the upper part of a copper-furnace at Mansfeld? The employment of fluoride of calcium in the melting-bed of the furnace which produced that felspar permits the belief that the fluorine intervened in that case as a transporting agent. It was evidently this which presented itself in our experiments, as in those which have been so often performed by M. H. Sainte-Claire Deville; the agents of the transport and crystallisation of the corundum and the silicate were likewise the fluorine compounds which we employed. It was to be presumed that this action of fluoride of barium upon alumina in presence of silica, forming a crystallised double silicate, would reappear as a general phenomenon connected with the decomposition of the fluorides by different bases. This we have, in fact, proved. In another communication we will discribe some crystallised double silicates produced under the same conditions as the double silicate of alumina and baryta; and then we shall give the general formulæ of these compounds.

Such is the brief account of our researches which we wished to present to the Academy. It is probable that our experiments, which give, in considerable masses, substances whose hardness is comparable to that of the natural ruby, will be utilised from time to time by the watchmaker, and even by the jeweller. We will say, in conclusion, that in this labour the aim we pursue is exclusively scientific; consequently we put into the possession of the public the facts we have discovered, and shall be very happy to learn that they have found useful industrial applications.

USEFUL INFORMATION.

Cleaning Swiss Watches.—One of our foreign horological organs illustrates the following two simple arrangements used in cleaning a Swiss bridge watch, lever, or cylinder. A small stand of gilded brass about 1¼ inches in diameter, and turned round in a lathe is employed. The latter is mounted on a firm base, with a stud in the centre running up to the plate; on this is engraved the shape of a watch movement with the bridges on it, and the screw-holes drilled in. When the watch is taken down the screws are placed in the holes as in the watch, and then left there until ready to put up again. Thus they get never mixed, and may be cleaned by carefully drawing a brush over them. The other arrangement is a tapering punch, something like a "pusher," used for pushing rivets out of pins, &c.; and after cleaning the bridges in a paper, as usual, the punch is pushed in the screw-hole with friction enough to prevent slipping. A fine brush is used for finishing.

Parallel Rules.—For lines parallel to the sides of the drawing board the T square is the best possible parallel ruler, and may be used in conjunction with set square of 45° for mitre and similar lines. The set square of 60° by 30° will give increased facilities in setting out many ornamental geometrical forms. A T square with shifting head is also very useful, but as ordinarily made it is clumsy. For parallel lines not falling within the range of the T and set squares, the best tool, in the opinion of many, is the rolling parallel ruler. This is more quickly set to any two points, and more cleanly in use than any other form. A plain black ebony one is best for general use. A set square and straight-edge are used by many, but they more easily get out of place and soil the paper. Set square and T squares should be French polished, and then they can easily be cleaned.—*Technologist.*

Lifting Springs are often broken, and the watchmaker has none of the right size, and has no time to make a new one. He can mend the old one and have it just as good as new, by placing the broken parts together, and binding them firmly to a piece of coal, and soldering them with 18 carat gold. It requires a strong heat and plenty of borax; then finish off nicely; harden and temper in the usual manner.

Solders.—Very fine and elaborate work is effected by using solders of different degrees of fusibility. For instance, a plate is soldered on with two carat gold; in that, another piece with silver, and so on; each subsequent solder being more fusible. In this manner jobs may be repaired that it would be impracticable to do by any other process.—*Metallarbeiter.*

Influence of Light on Metals.—Some time ago M. Siemens discovered the influence of light on the electrical resistance of selenium, and constructed a new photometer based on this principle. Recent experiments have shown that light similarly acts upon tellurium, but in a less degree. In a note to the Philosophical Faculty of Heidelberg, M. Boernstein states that light also effects platinum, gold and silver, and probably all the metals.

BRITISH HOROLOGICAL INSTITUTE.

At the usual Monthly Council Meeting held on the 8th ulto., a communication was received from the Turners' Company, stating that the Company had passed a resolution to annually present a Silver Medal to the Institute. A letter was read from Mr. W. H. Bennett, Secretary to the Watch-Case Makers' Society of London, asking the Council to receive a deputation from the Case Makers' Society, with a view to obtaining the co-operation of the Institute in an effort being made "to suppress the fraudulent and injurious practice of stamping foreign-made watch-cases with the British Hall Mark." The Chairman said that with every desire to be courteous to the case makers, he thought that unless the Institute was prepared to join with them in their endeavour to obtain protection, the Council should not receive the deputation. In his opinion the day had gone by for such restrictive measures as the case makers desired. They might just as well ask for an enactment to prohibit the introduction of Swiss movements in order to benefit the Lancashire movement-makers, or try to foster the making of English main-springs by not allowing those of foreign make to be sold. While there was no doubt the name of every manufacturer of note had been forged on spurious watches, and the buyers, in some instances, unfortunately looked upon the Hall mark as a guarantee of the genuineness of the watch, he believed no remedy which interfered with free trade was advisable or stood any chance of recognition by Parliament. Besides, what the case makers asked for would not touch the evil. Mr. Bacon pointed out that even if only cases of English make were Hall marked, it would still be open for any one to place foreign movements in English cases. Mr. Jackson said he wished they could see their way clear to accede to the request of the case makers and receive the deputation, because, he was afraid, the case makers would look upon a refusal as indicating an antagonistic spirit on the part of the Council; but, looking at the terms of the application, he observed the object was "to suppress the fraudulent practice," &c. As they well knew, the practice of marking foreign cases was legal and not fraudulent, and he would, therefore, move that "As the practice of stamping foreign-made watch-cases with the British Hall mark is legal and not fraudulent, the Council decline to receive a deputation on the basis set forth in the letter of Mr. Bennett." After considerable discussion, this resolution was carried unanimously.

CORRESPONDENCE.

It must be distinctly understood that we do not necessarily identify ourselves with the opinions or views of any of our Correspondents. Our pages are alike open to all for free discussion of questions connected with the various trades which we represent, and all Correspondents will find every opportunity afforded them for expressing their opinions.

FREE TRADE IN SILVER PLATE.

To the Editor of the Watchmaker, Jeweller, & Silversmith.

Sir,—Many of your readers, being dealers in, and not manufacturers of silver plate, will be interested in the document lately issued by the Goldsmiths' Company. In this notice to the trade we are reminded that the law does not permit foreign plate to be imported into this country, and to be sold, without its being previously assayed and marked at Goldsmiths' Hall. Doubtless manufacturers, as consistent monopolists, will have welcomed this reminder of the Company; doubtless they will rejoice should the Company succeed in finding one of these terrible criminals who have imported large quantities of foreign plate, and have sold it, without having previously consulted the wardens of that eminently enlightened guild, presided over as it is by the great engineer Mr. Bramwell, assisted by his three wardens, Mr. Copeland (a procelain manufacturer), Mr. Norbury (a stockbroker), and Mr. Fleming (a merchant), not one of whom has the slightest possible knowledge of the interests of the craft over which he presides. But it is not my desire to find fault with the Goldsmiths' Company for their endeavour to obey the law of the land. My object is to point out how foolish the law is; how detrimental to our interests as dealers in silver plate. What the exact proportion of dealers to manufacturers really is can only be conjectured. There are 12,777 individuals licensed to sell gold and silver plate, of whom there cannot be less, but possibly there are more, than 11,000 dealers, whose interests are to buy and to sell foreign productions without being included among the criminal classes. It is simply monstrous that in these days of Free Trade, a respectable man should be threatened with criminal proceedings when honestly pursuing his calling. It is wholly indefensible that there should be one law for a silk-seller, a jeweller, a pianoforte, furniture, or other dealer, and another law, and that a penal law, for the vendor of silver plate. Why, I ask, am I to be deprived of the right to sell foreign plate, if I can find a customer to buy it? Why must I, before I can offer it for sale, be obliged to send it to Goldsmiths' Hall, there to be scraped, assayed, and marked, and thereby injured beyond hope of restoration? What I want to show your readers is that this prohibition of foreign plate (for prohibition it virtually is), is a manifest injustice to many thousands of honest and industrious citizens. It is impolitic, as in hampering the trade, and thus preventing retailers from doing profitable business, the Revenue loses the income tax which would arise from their increased prosperity, and the country is the poorer by reason of their limited transactions. It is idle to contend that silver plate can be sold provided it be marked. I assert, without fear of contradiction, from personal experience, that finished artistic plate cannot be marked; therefore it cannot be sold. It may be imported; duty may have been paid upon it; but it cannot be marked without such serious injury to the fine work as would utterly prevent its sale. Other trades have no such restrictions, why should the silver trade be so hampered? The days of monopolies are ended. This is a period of Free Trade. It is no part of the duty of Government to prevent the free sale of commodities, be they what they may, or in whatever market they may be procured. If people cheat each other, the law-courts will settle disputes. The population has increased to such an extent as to render the monthly nurse legislation of centuries ago perfectly ludicrous in these days. We must put our shoulder to the wheel and cut asunder the cords which now bind us, enervating our energies and crippling our enterprise.—I am, Sir, your obedient servant,

Pall Mall East, Jan., 1878. Edward J. Watherston.

FOREIGN PLATE.

The following notice has recently been issued to the Trade by the Goldsmiths' Company:—It having been brought to the notice of the Goldsmiths' Company that articles of Silver Plate in considerable quantities have been for some time past imported into this country from foreign countries and sold without having been assayed and marked as required by law, the Wardens of the Company consider it their duty to remind Dealers in Gold and Silver Plate of the laws which prohibit the sale of Foreign Plate of Gold and Silver imported into this country, unless it be of one of the authorised standards, and shall have been assayed and marked; and the Wardens at the same time notify that they will consider it their duty to institute proceedings at law against offenders in every case of an offence committed in breach of the law which shall be brought to their notice and capable of proof.

The following are the enactments above referred to:—

5 and 6 Victoria, Cap. 47, Sec. 59.

And be it enacted, That all Gold and Silver Plate not being battered, which shall be imported from Foreign Parts, after the commencement of this Act, and sold, exchanged, or exposed to sale within the United Kingdom of Great Britian and Ireland, shall be of the respective Standards now required for any Ware, Vessel, Plate or Manufacture of Gold or Silver wrought or made in England; and that no Gold or Silver Plate so to be imported as aforesaid, not being battered, shall be sold, exchanged, or exposed to sale within the said United Kingdom, until the same shall have been assayed, stamped, and marked, either in England, Scotland, or Ireland, in the same manner as any Ware, Vessel, Plate, or Manufacture of Gold or Silver wrought or made in England, Scotland, or Ireland respectively is or are now by law required to be assayed, stamped, and marked; and that every Goldsmith, Silversmith, or other Person whatever who shall sell or expose to sale in England, Scotland, or Ireland any Gold or Silver Plate so to be imported as aforesaid and not being battered before the same shall have been so assayed, stamped, and marked as aforesaid, shall be subject and liable to the like Penalties and Forfeitures in all respects, and to be recoverable in the same manner, as the Penalties and Forfeitures now by law imposed upon Goldsmiths and Silversmiths selling, exchanging, or exposing to sale in England, Scotland, or Ireland respectively any Ware or Manufacture of Gold or Silver Plate made or wrought in England, Scotland, or Ireland respectively and not assayed, stamped, or marked as required by law; Provided always, that no Article or Ware of Gold or Silver so to be imported as aforesaid shall be liable to be assayed, stamped, or marked as aforesaid, which would not be liable to be assayed, stamped, or marked if it had been wrought or made in England.

5 & 6 Victoria, Cap. 47, Sec. 60.

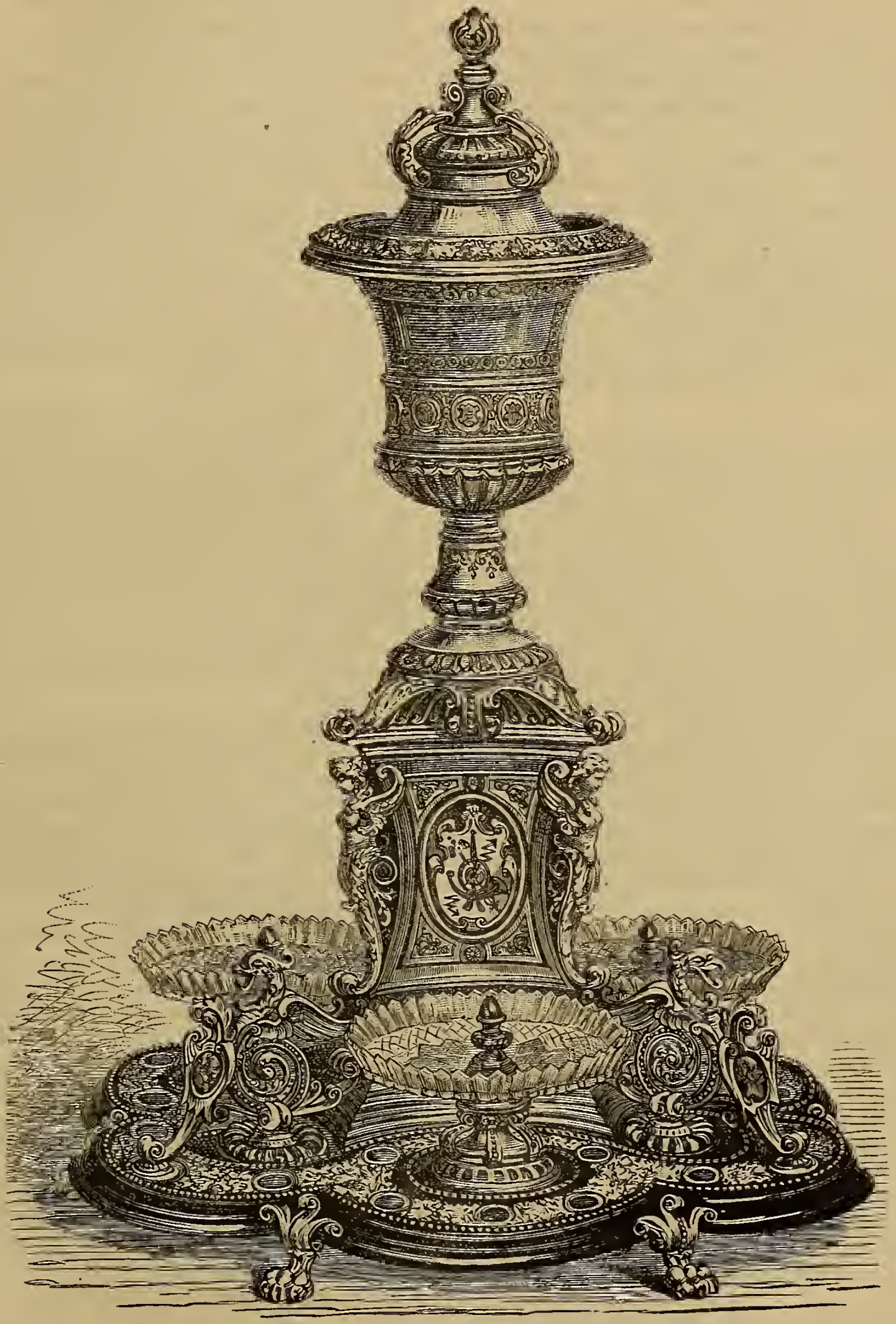
And be it enacted, That in order that Gold and Silver Plate so imported as aforesaid may be assayed, stamped, and marked, it shall and may be lawful for any person to send the same to any Assay Office in the United Kingdom at which Gold and Silver Plate is now by law required to be assayed, and when so sent it shall be assayed, tested, and stamped, and marked in such and the same manner, and be subject to such and the same charges other than Stamp Duty, as if the same were British Plate by law assayable in such Office; and the Wardens and Officers in each such Assay Offices and the persons employed by them, shall have such and the same powers of assaying, touching, testing, marking, cutting, breaking, or defacing such Gold and Silver Plate so sent to be assayed as are now by law exerciseable by such Wardens, Officers, and other Persons in respect of Gold and Plate now by law required to be assayed in such Assay Offices:—

30 & 31 Victoria, Cap. 82, Sec. 24.

All Gold and Silver Plate which shall be imported from Foreign Parts, and which Gold and Silver Plate is now or shall at any time hereafter be by law required to be assayed, and which when so sent shall be then assayed, tested, stamped, and marked, shall, in addition to the marks for the time being used at such Assay Office for the purpose of marking British Plate be marked with the further Mark of the Letter F on an oval escutcheon, in order to denote that such Gold or Silver Plate was imported from Foreign Parts and was not wrought or made in England, Scotland, or Ireland; and the Wardens and Officers in such and every such Assay Office, and the persons employed by them, shall have power to impress and mark, and shall impress and mark such further and additional mark, before such Plate shall be delivered out from such Assay Office.

PRESENTATION PLATE.

THE accompanying wood-cut illustrates a silver centre piece manufactured by Messrs. Meyen and Co., of Berlin, and presented to Herr Sachse, Imperial Post Director of that city, as a mark of recognition for fifty years' valuable service. The design, the result of a public competition, is after first class models of the Italian and German renaissance. A base of polished ebony, rounded off in six semi-circles and decorated with dull silver ornaments, carries in its centre the trilateral pedestal, with a female figure on each of the edges. Three supporters bear the medallion portraits of the three Prussian Kings, Frederick William III., Frederick William IV., and William I., under whose rule the jubilant has served. The three sides of the pedestal are beautifully ornamented with the emblems of the post, pneumatic post, and telegraphy, and one of them contains the name of the recipient, date of presentation, etc. The cup, with its base and rim supported by shellwork, shows the arms of ten different cities in which the presentee has resided. Glass dishes for the reception of fruit occupy the three large spaces on the base of the centre piece. Two five-light candelabra, remarkable for the variety and beautiful shades of gold and silver, accompanied this handsome gift.



ON THE COLOURING OF AGATES, &c.

(Continued from page 131.)

REPEATING our belief, that under the various caprices of fashion, the time may not be far distant when this species of gem-stones may again be sought for and become popular, we continue our remarks on the artificial methods employed in improving and varying their appearance.

It must always be borne in mind that there are two agents which are specially operative in producing these effects: heat, and acids; and leaving to the practical knowledge of our lapidaries and jewellers the preferable methods of employing them, we proceed to offer to their notice the different modes which we have culled from various sources.

Dr. Billing observes that a strong prejudice exists in favour of the black, or brown, and white *Oriental* onyxes, whether for gems or beads, on the supposition that they are not stained by art, but are in their natural state. This is generally believed by the jewellers and lapidaries, which error can only be corrected by a knowledge of chemistry, which few possess; besides which, they are ignorant of the method used by the Orientals of staining black and brown. This he proceeds to explain, and as we deem it of some importance, we shall to some extent extract his remarks.

When the black and brown produced by sulphuric acid is too dark, it can be "drawn," that is withdrawn, made lighter by *nitric acid,* which re-dissolves the dark matter produced by the sulphuric acid. This dark matter is a kind of "humus," or slag, which can be faded entirely or reduced to a slightly yellowish tint by the nitric acid. It should be observed, however, that for various reasons this method has not so quick an effect with the Oriental beads as it has with those of German production. Lapidaries should notice this, because, finding that they cannot "draw" the black from Oriental onyx in a few *hours,* as they do from the German stained onyx, they think the stone was originally black by nature. This, however, is a mistake, owing to their not having allowed sufficient time for the effect. The best authenticated Oriental beads may be deprived of the black and brown by nitric acid in the course of fourteen *days,* more or less. (A bit of charcoal soaked with them becomes bleached, and changed into a pale flacculent residuum, the black carbon being converted into carbonic gas by the oxygen of the nitric acid.)

If the stone which has thus been made paler be again subjected to a strong heat, the vegetable matter remaining in it may be again burned black, like the Oriental stones, which black will now resist nitric acid as much as do the Oriental stones themselves. With regard to the means of imitating that natural orange or yellowish brown of Brazilian or Oriental sard, which is produced by the slow process of ages, in depositing a sufficient quantity of the peroxide of iron, Dr. Billing observes that although the lapidaries have not succeeded in so doing, he has done so himself by using a *neutral* solution of pernitrate of iron, and keeping the stones in it, warm, for *weeks* instead of *days,* renewing the water of the solution from time to time as it evaporated. It must be observed that the solution of pernitrate of iron must not have excess of acidity, or it will not have due effect.

It is almost needless to repeat that in carrying out the various processes of staining, compiled and described in this paper, considerable practice is required as to the degrees of heat to be applied; the length of time necessary for drying, *before* the application of heat; the changing and re-changing from one solution occasionally to another; and a variety of *minutiæ* which are acquired only by experience. It requires also some practice to know which parts of an uncut stone will admit of or resist these methods, and it is necessary to be aware, in making experiments, that the outside of a stone which has been long exposed to the weather will not be affected by the staining process, but that when the surface has been ground off the interior will receive the stain.

Our author mentions that he has stained chalcedony *blue* on the same chemical principles as those which produce *red;* that is, introducing the peroxide of iron in solution into the stones, in the same way; and then, instead of heating them to turn them *red,* precipitating the imbibed iron blue by soaking them in a solution of ferrocyanide of potassium (*yellow* prussiate of potash), in water, in the proportion of one scruple of the ferrocyanide to each ounce of water; in fact, making Prussian blue in the pores of the stone. In staining *blue,* the effect is sooner produced by soaking the stones *first* in the solution of ferrocyanide, and *then* in the iron liquor. Blue can be produced also by *proto*-sulphate of iron and *ferrid*-cyanide of potassium (*red* prussiate of potash). A *green* colour, resembling that of the chrysoprase, has, as the author is informed, been imparted to pale, translucent chalcedony, by soaking it in a saturated solution of nitrate of nickel (the common *unpurified* nickel) as it is obtained from the ore, which always contains an alloy of cobalt. The metal is to be dissolved in a mixture of one part pure nitric acid to three parts water, with heat, putting in, to ensure saturation, more metal than can be dissolved. The solution is to be filtered and evaporated, until crystals begin to appear.

The stones must remain in the liquid for a long time, as the process is much slower than that for producing red, brown, or blue. The *blue* colour is likely to fade.

To produce *yellow,* the action of *hydrochloric* acid is required on a stone faintly impregnated by nature with oxide of iron, when a yellow tint is produced; but there are very few stones that can be stained of this colour, as it requires a nice eye to distinguish whether the stone possesses the requisite qualities for its transformation.

The above remarks coming from a practical chemist, are doubtless of value, and we trust may be serviceable to some of our readers.

It must not be supposed that this colouring of gem stones is a modern notion, for we find by Pliny that the Orientals, even before his time, had discovered and practised the art of "improving" the onyxes and sardonyxes, colouring them red, black, and brown, so as to imitate sards or carnelians. The latter word, however, is evidently a modern Italian word, *carniola,* from *carne,* flesh; nevertheless, yellow, and even white carnelians may be met with.

Of course, modern skill improves on all earlier endeavours. Thus we find that the ancients produced only small specimens of their art, but now-a-days we see many articles nine or ten inches long of red carnelian, transformed from slabs of pale grey translucent chalcedony, and indeed such sards, onyxes, &c., are now developed as to astonish engravers who began their labours in the early part of the present century, for in fact a carnelian for an intaglio might now be produced larger than a man's hand. Among the crown jewels of France was a very valuable set of agates, ten cups and saucers, four urns, four chandeliers, four busts, two ewers, two basons, two vases, two bowls, two salvers, one decanter, and one candlestick; the whole set being valued at 500,000 francs. We are not aware if they are still existing intact, or if they have been dispersed.

Of course the increased facility of staining stones brings into the market immense numbers of inferior carnelians, &c., as well as the fine ones. The Oriental (Indian, Asiatic, or African) do not differ much from the Brazilian and German; by these we imply the finest and the inferior qualities. We can match the finest specimens of antique gem stones, some of which are themselves artificially coloured. In fact, the system has been at all times prevalent; and we would therefore refer our readers to some of our previous remarks on the necessity of profound discrimination before themselves purchasing any gem-stones said to be genuine, and consequently of increased value. For, in fact, there are none of the onyxes with white, and *quite black* layers that have not been stained artificially, whether they come from India, Brazil, Germany, or elsewhere. And not only in the stone itself, but in articles manufactured from it, such as cups, &c., which sometimes look like tortoiseshell, beautifully shaded, but which are tinted and shaded by the various processes we have herein described.

This paper being intended to be of practical utility, a few more observations may not be unacceptable. We had selected a variety of receipts from various authors, but they all converge to the dictum of Dr. Billing, that the base of all transcolouration is heat and impregnated acid. We prefer, therefore, in a great measure continuing our compilation chiefly from his useful work.

A beautiful transparent *brown* may be artificially produced by *neutral pernitrate* of iron, or by tinting a natural orange stone, with honey or syrup and *sulphuric* acid, which will darken the orange. But this must be done carefully, or the stain will be black. Referring to the *white chrystalline layers* of onyx, it appears that they are capable of great improvement; and some layers of the chalcedony which are so translucent as not to be visibly white, may be so much whitened as to be available for onyxes. By a strong heat, sufficient to char wood, the brown of the sard is changed to carnelian red; and by heat also the translucent layers of crystalline structure are turned white. The white of onyxes is, however, improved by other methods besides heat, but this is only superficially so. It may be effected by concentrated acid, either sulphuric or nitric. With these remarks we conclude our observations on the colouring of these gem stones, repeating only what has been previously advanced, that in skilful hands this trade might be successfuly carried on by our manufacturers to a profitable result. The supply from the East is now much restricted. Latterly immense quantities are manufactured on the Continent, and exported to Burmah and other parts of India for the use of the natives, as they are supplied cheaper than they could be produced in those localities.

An inspection of arrow-heads and other flint instruments will show that they were produced by the use of the hammer; so of agates, which would require a long time to shape them by the grindstone or sawing across. Blocks of chalcedony are broken with great accuracy by a chisel, placed in the desired direction, and struck with a hammer, and the pieces are again broken smaller to the size required, for shaping and polishing on the mill to make agates or onyxes. But if the stones are of fine quality, and with such layers as will produce good onyxes, they must be cut with more precision, which is done by the process as hereafter described. To *prepare* seal-stones or onyxes, the rough lumps of chalcedony, carnelian, sard, and onyx stones are slit, shaped, and polished by the *lapidary.* The slitting is effected by a machine which turns a circular iron plate as thin as card paper, twelve inches or more in diameter, the edge of which being smeared with oil mixed with pounded diamond, saws through the stone, which is then further ground to the required shape by a revolving flat circular piece of lead or pewter, called a lap, with coarse emery powder and water; and lastly the seal-stone or onyx is polished by a lap of wood, or a wooden lap covered with felt or cloth, and fine emery, tripoli, crocus, or other polishing material and water. The slitting is effected in some countries by emery powder and water, or oil, instead of diamond powder and oil; but much more slowly. Sometimes by a bow with a wire string, instead of the iron plate: this method is still practised in India, and some places on the Continent. The various processes as above described are those generally in use in the shops of our lapidaries, who sell the stones thus prepared to the gem engraver. At some future time we may describe the processes he employs, as well as the special art of producing cameos.

Feuchtwanger observes that the value of agates, although much reduced in comparison to former days, still commands a good price in the market, and particularly the onyx, which on that account, he adds, is frequently imitated by pasting thin plates of chalcedony, jasper, &c., making them appear like real onyx. This deception may easily be detected by putting the stone into hot water, also by the deficiency of hardness prominent in the real stones.

Greek Jewellery in the British Museum.—Among the recent acquisitions of the British Museum is a small series of very beautiful gold ornaments found together in a tomb at Cyme, in Æolis. The series includes two pairs of splendid earrings formed of large discs, ornamented with filigree work, from which are suspended by fine chains inverted pyramids, also covered with filigree work, and in some parts with enamel. Between the disc and the pyramid is a kneeling female figure, draped. One of the necklaces is very elaborately enriched with filigree work. With these ornaments was found a gold statue of Alexander the Great, which naturally determines the date of the jewellery as not before his time, a result which would also be arrived at from what is already known of the characteristics of Greek jewellery. It cannot well be long after his time, and in all probability is contemporary with him.—*British Trade Journal.*

Church Plate.—Messrs. Marshall & Sons, George Street, Edinburgh, have just completed a communion service of plate which is intended for St Mary's Cathedral, when that edifice is completed. The plate was designed from a service in the possession of the Marquis of Douglas, which was brought from La Marca, in Spain, and is executed in solid silver richly gilt. The service consists of a wine flagon, two chalices, a large paten, and two smaller ones, the whole being enclosed in a Gothic oak case lined with purple velvet. The flagon stands 16 inches high, the base showing a device of fleur-de-lis, surmounted by a crown of thorns, while the body of the vessel is nicely ornamented with vine eaves in *repoussée* work. The cover of the flagon is tastefully chased, and bears a cross and gloria. The chalices are 7½ in. in height, and the patens 8½in. and 7½ in. in diameter. The latter vessels are simple, burnished with chased edges and engraved cross in the centre. Chalices and flagon alike are studded with Indian carbuncles, and each piece bears the inscription in Old English characters, "St Mary's Cathedral, Edinburgh, 1878."

Bridal Gifts.—Among the wedding presents of the lately married Countess of Aberdeen were the following articles, comprising a list that assuredly few brides have been favoured with. Seven complete *parures*, including necklace, pendant, earrings, and bracelet. Three of pearls, and diamonds, one gold, one of Indian stones, another of pearls and turquoises, and one of pearls, diamonds and uncut emeralds. Besides these were nineteen single bracelets. Five were of diamonds, three pearls and diamonds, one diamonds and rubies, three pearls, one pearl and amethyst, one coral and pearls, one diamond and turquoises, and the rest of gold. Eight pairs of earrings, of pearls, diamonds, sapphires, and enamel. Eight medallions of opals, diamonds, sapphires and emeralds, and a tiari formed of five diamond stars, the centre one being exceptionally large. None of these were included in the casket containing Lord Aberdeen's family jewels, which held almost as many *parures*, bracelets, &c., as those above described.

Workmen at the Exhibition of 1878.—The Municipal Council of the City of Paris has granted a piece of corporation ground at the Avenue de la Bourdonnaie for a workman's exhibition. A sum of £2,000 has also been voted to enable them to exhibit their inventions and products personally—an advantage of which they are generally deprived by the want of adequate means.

CURIOSITIES OF CLOCKS AND WATCHES.

Whoever invented or applied the pendulum, it seems that so early as the year 1000 of the Christian Era the Arabs were acquainted with the fact that a pendulous body, when set in motion, made two hundred oscillations in a given time, and that the time was exactly doubled when it had made four hundred.

Soon after the application of the pendulum to clocks the idea of Gemma Frisius, of a portable clock for ascertaining the longitude at sea, was attempted to be realised by Huyghens in the construction of a marine clock to ascertain the longitude. He also discovered that its pendulum vibrated slower as it approached the equator, which fact led the way to the subsequent discovery that the earth is not a globe, but an oblate spheroid. The *New York Independent* for December 15th, 1859, makes the following statement relative to a clock with a pendulum made by Huyghens:—"*The Hartford Times* says that a watchmaker in that city has repaired and set in running order a German clock more than two centuries old. It was built by Huyghens somewhere about the year 1640 (?), and though it has not run for more than half a century, is now keeping good time, and may last another two centuries. It was found by the artist Church in the possession of a Dutch family in Nova Scotia, while he was off on his iceberg sketching expedition. In that family it had been handed down from father to son for generations. This is one of the very first clocks ever made with a pendulum. The action of the pendulum on the wheel is not direct by means of a pallet, as in the modern clocks, but operates by a vertical bar with "snugs" on it, catching into the teeth at each oscillation of the pendulum. The clock strikes for the half-hour and hour, and is wound by means of an endless chain. It has an open frame of black ancient oak, exposing the works, which are of brass and nicely finished."

In the South Kensington Museum is an astronomical clock, which was made by George Rollet and John Reinhold, of Augsburg, in 1584, and is said to have been constructed for the German Emperor Rudolph II. This instrument, which was presented to the Museum by Mr. R. Goff, consists of guilt metal in the form of a celestial globe, inscribed with the signs of the zodiac and other astronomical figures. On an orb below the globe is engraved the imperial two-headed eagle, crowned; and the globe itself bears in Latin the names of the makers, with the date. The whole is about sixteen inches in height, and the globe is seven inches and a half in diameter. This clock is engraved in the *Illustrated London News* of April 7th, 1866, page 336.

The will of Bartholomew Newsam, of the Strand, clockmaker, dated in 1586, a copy whereof is given in the "History of Clerkenwell" by Pinks and Wood, contains some curious and interesting bequests of clocks and the tools for making them. The testator gave to his apprentice his "seconde clocke;" to a relative, his "best vice, save one a beckhorne to stand upon borde, a great fore hammer, and to (two) hand hammers, a grate longe beckhorne in my backe shoppe; and all the rest of my tooles I give unto Edward Newsom, my sonne, with condicon that he become a clockmaker as I am; yf not I will the foresaid tooles to be sould by my executors." He gave to a friend "a sonne dyall of copper gylte;" to another "one cristall jewell with a watche in it, garnished with goulde;" to another, "one watche gylte to shewe the hower;" to another, "a strikinge clocke in a silken purse, and a sonne dyall to stande uppon a post in his garden;" and to another "a chamber clocke of fyve markes price." We find in the "Calendar of State Papers," of the time of Queen Elizabeth, a grant in 1572 to B. N. (who no doubt was Bartholomew Newsam) of the office of clockmaker to the Queen in reversion after the death or surrender of N. V. (probably Nicholas Urseau). In the same calendar is a letter dated August 5th, 1583, from Bartilmew Newsham to Sir Francis Walsyngham, to favour the writer's petition to Her Majesty for the augmenting a certain term of years wherein he had moved Sir Philip Sydney to speak to him. And under date 1590 we find a grant in Bartholomew Newsham of the office of clockmaker to the Queen in place of Nicholas Urseau, deceased. We learn from Queen Elizabeth's Household accounts that she had in her service a clockmaker who was receiving an annual fee of £18; and a clock-keeper who was receiving £12 13s. 4d. per annum. Hetzner, who wrote in the time of Queen Elizabeth tells us that that queen had in her palace at Whitehall a piece of clockwork consisting of an "Aethiop riding upon a rhinoceros, with four attendants, who all make their obeisance when it strikes the hour; these are all put into motion by winding up the machine."

At a meeting of the Royal Society held in March, 1848, a clock constructed by Isaac Habrecht in 1589 was exhibited. This ingenious piece of workmanship was for more than two centuries in the possession of the court of the Popes of Rome, and was subsequently the property of William I., King of the Netherlands, who authorised Odevaere, the antiquary, to investigate everything concerning it, and to give a description of it, which he did in writing. It was exhibited in England in 1850, and afterwards came into possession of Mr. O. Morgan.

The entire fabric bears decided proof of having been produced by manual labour, without any other assistance than the bench of the turner and the file. It had the ancient motive power, the pendulum being a later invention, which has since been added to this clock. The design consists of a tower, divided into three storeys, with doors of strongly gilt copper, tastefully chased and ornamented, and supported by twelve columns of the same metal. In front of the lower storey, within a square chamber, is a large dial plate, which moves round its whole circuit only once a year: it shows also the date of the month, and all the Catholic feasts and holy days throughout the year. In the centre is a small plate very curiously chased representing the twelve signs of the zodiac, with the sun and moon pursuing their course, so that at one glance can be ascertained in what signs of the zodiac they are at the time. Within this circle is a small globe, pointing out the proper phases and aspects of the moon, and within all this are the fixed stars setting, namely, the Serpent, Orion, the Great Bear, Casseiopeia, and others. The four corners of this chamber are emblematically engraved with the names of those nations who have conquered kingdoms at an early period. In front of the second storey are the minutes and minute hand, and on each side are two silver figures, one hand of these figures pointing to the minutes, the other hand being set in motion by mechanism, during the striking of the clock; the one figure turns the hour glass, as an emblem of Time, and the other wields the sickle of Death. Above each of the figures is a Latin verse, and in the middle of the plate is a simple yet correctly mathematical representation of how the globular form of the earth is perceptible to the eye. Above, the minute hand describes a circuit of twenty-four hours, each half of the dial-plate containing twelve hours; the day hours being marked with the image of the sun, and the hours of the night with the image of the moon. On the four corners of the dial-plate are engraved the four seasons of the year.

(*To be continued.*)

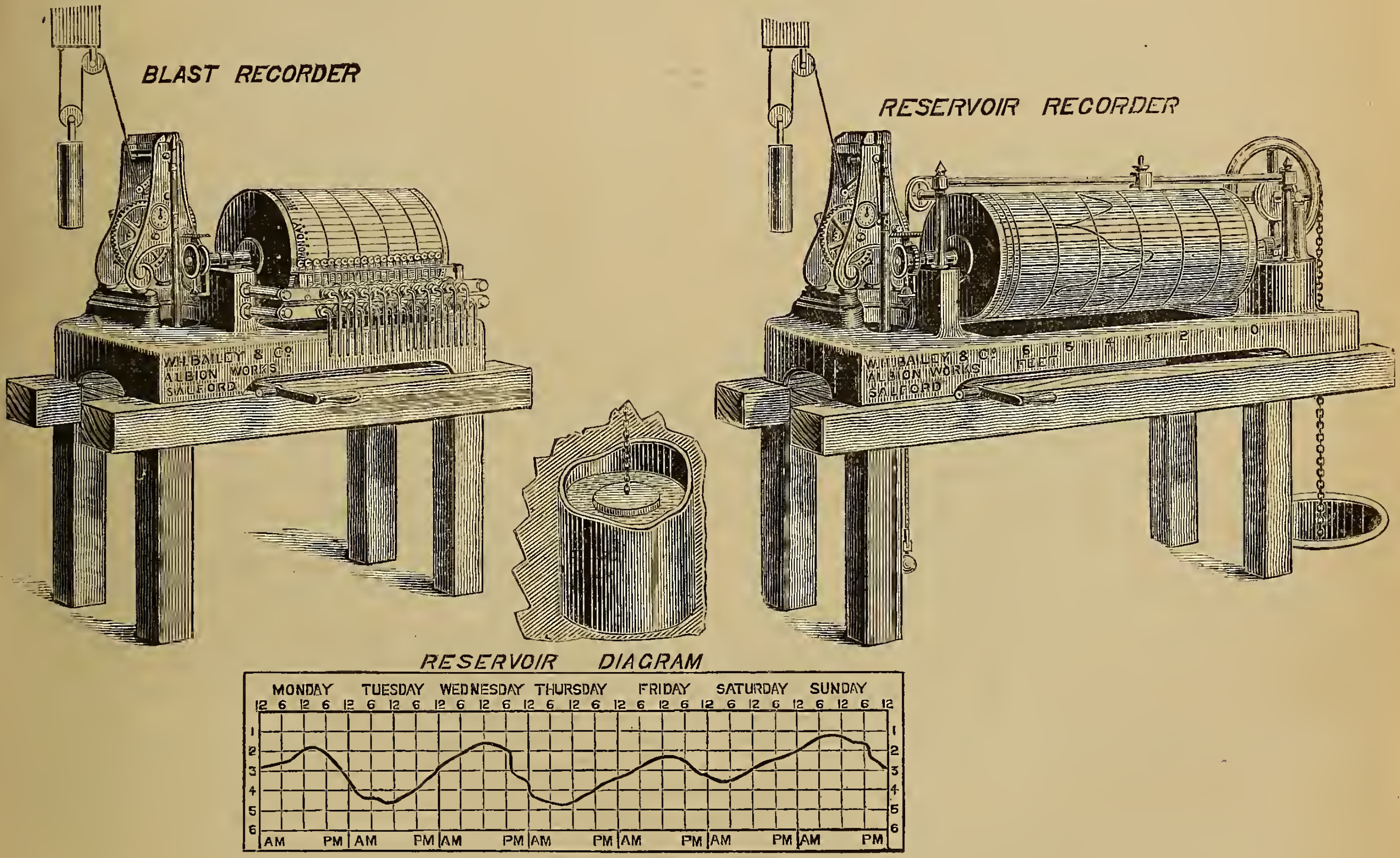
The Universal Collar Stud.—Under the above name a new patent collar stud of considerable merit has recently been introduced, and for which Messrs. Swinden and Son, of Temple Street, Birmingham, are, we believe, the sole agents. The patent consists of a revolving action of the upper part of the stud, thus entirely preventing the very uncomfortable pressure on the neck so much complained of in the ordinary fixed collar stud. The new patent affording far more comfort to the wearer will doubtless command a great sale.

INTERESTING CLOCKWORK MECHANISM. BAILEY'S TESTING APPARATUS.

THE accompanying illustration is from a photograph of testing, indicating, and recording apparatus, for various purposes, which has recently been made by Messrs. W. H. Bailey and Co., of the Albion Works, Salford.

The reservoir recorder is one of a number made to indicate the fluctuations of the water in the reservoirs of the Sheffield Water Works. In constructing this recorder, which is probably of larger dimensions than any similar instrument hitherto made, Messrs. Bailey and Co. have followed the instructions of Mr. Edward M. Eaton, the mechanical engineer of the Waterworks Company. The drum performs a revolution once a week, being driven by a small turret timepiece, strong enough for the purpose, and the clock beats seconds. A friction clip in connection with the set dial enables the drum to be set to the true time without difficulty. The diameter of the drum is 12in., and its length is 3ft., a fluctuation of 6ft. being recorded, thus giving a scale of 6in. to a foot. This reduction of scale is obtained in a very simple manner, the float pulley upon which the chain is fixed being double the circumference of the pulley which actuates the pencil, and which is guided by the two horizontal brass bars over the top of the drum, in order to prevent any possible error from backlash of the mechanism, or by wear and tear in the ordinary course of use. The float, it will be observed, is balanced by a small weight attached to a chain, which is fastened to the pencil-block; this enables a very sensitive diagram to be taken. The illustration at the bottom of the engraving shows a diagram, which will scarcely require any further explanation. Three of these recorders are now being fixed at Sheffield, and suitable instruments are also being made for other waterworks in other parts of the country.

Somewhat similar in design is the recorder in the left-hand corner of the engraving; the dimensions of the drum and of the timepiece are similar to the reservoir recorder which we have just described, but the instrument has been constructed for a different purpose. In this the manufacturers have followed the suggestions of Mr. Walter Crooke, the chief engineer of the extensive blast furnaces of the Cumberland Iron Mining an Smelting Company, Limited, Millom, Cumberland. It may be proper to say that the improved hot blast fire-brick stoves now used for heating the air used for the blast furnaces are worked intermittently, and the results depend a very great deal—in fact, we may say altogether—upon the regularity of the performance and punctuality of the men who have charge of them. This will be understood by those engaged in blast furnace operations. In a very simple manner each blast furnace has its performance recorded upon the revolving diagram. In all, the performances of twenty-one engines are indicated and recorded upon the drum. Each engine has its own separate and independent pencil, which records its performance on the paper, and this is done in the following manner: A pipe leading from the blast pressure terminates at a cross-bar opposite the drum, to which the pencil mechanism is fastened; when the blast comes on a small piston is caused to project forward forcing the pencil upon the paper; the joint is made air-tight by means of an elastic diaphragm, about an inch in diameter. There are means of adjustment and other details which have required great care in their development, and to which it may be unnecessary for us to refer. The engraving will give a very good idea of the instrument, which supplies a very simple way of obtaining important results. As the diagram makes a revolution once a



week it will be apparent from our description that the number of hours worked by each blast-engine can be at once seen by the length of the stroke which its pencil has made upon the paper. By then comparing the number of strokes made per minute, or per hour, by each engine, important calculations may be made and statistics obtained which will bear upon economy of manufacture in another direction, in addition to the valuable results obtained from a punctual discharge of duty by the men who have charge of the blast-engine.

HOW TO PREPARE AND APPLY FOILS FOR STONES.

Foils are thin plates or leaves of metal that are put under stones, or compositions in imitation of stones, when they are set. The intention of foils is either to increase the lustre or play of the stones, or more generally improve the colour by giving an additional force to the tinge, whether it be natural or artificial, by that of a ground of the same hue, which the foil is in this case made to be.

There are consequently two kinds of foils: the one is colourless, where the effect of giving lustre or play to the stone is produced by the polish of the surface, which makes it act as a mirror, and by reflecting the light, prevents that deadness which attends the having a duller ground under the stone, and brings it, by the double refraction of the light that is caused, nearer to the effect of the diamond. The other is coloured with some pigment or stain of the same hue as the stone, or of some other which is intended to modify and change the hue of the stone in some degree; as, where a yellow foil may be put under green, which is too much inclining to the blue, or under crimson, where it is desired to have the appearance more orange or scarlet. Foils may be made of copper or tin, and silver has been sometimes used, with which it has been advised, for some purposes, to mix gold; but the expense of either is needless, as copper may be made to answer the same end. Various methods are employed for preparing copper for foils, and for whitening and colouring foils, but the following have the sanction of the best authorities we have consulted on the subject.

Where coloured foils are wanted, copper may be best used, and may be prepared for the purpose as follows: Take copper plates beaten to a proper thickness, and pass them between a pair of fine steel rollers very closely set, and draw them as thin as is possible to retain a proper tenacity. Polish them with rotten-stone till they shine, and have as much brightness as can be given to them, and they will then be fit to receive the colour.

Where the yellow, or rather orange colour, of the ground would be injurious to the effect, as is in the case of purples, or crimson red, the foils should be whitened, which may be done in the following manner:

Take a small quantity of silver and dissolve it in aqua fortis, and then put bits of copper into the solution, and precipitate the silver, which being done, the fluid must be poured off, and fresh water added to it, to wash away all the remainder of the first fluid, after which the silver must be dried, and equal weight of cream of tartar and common salt must then be ground with it, till the whole is reduced to very fine powder, and with this mixture the foils, being first slightly moistened, must be rubbed by the finger, or a bit of linen rag, till they be of the whiteness desired. The polish must be refreshed if it appears to be wanted.

The tin-foils are only used in the case of colourless stones, where quicksilver is employed, and may be drawn out by the same rollers, but need not be further polished, as that effect is produced by other means in this case. The manner of preparing foils, so as to give colourless stones the greatest degree of play and lustre, is by raising so high a polish or smoothness on the surface as to give them the effect of a mirror, which can only be done in a perfect manner by the use of quicksilver applied in the same general way as in the case of looking-glasses. The method by which it may be best performed is as follows: Take leaves of tin prepared in the same manner as for silvering looking-glasses, and cut them into small pieces of such size as to cover the surface of the sockets of the stones that are to be set. Lay three of these then one upon another, and having moistened the inside of the socket with thin gum water, and suffered it to become again so dry that only a slight thickness remains, put the three pieces of leaves, laying in each other into it, and adapt them to the surface in as even a manner as possible. When this is done, heat the socket, and fill it with warm quicksilver, which must be suffered to continue in it three or four minutes, and then gently poured out. The stone must then be thrust into the socket and closed with it, care having been taken to give such room for it that it may enter without stripping off the tin and quicksilver from any part of the surface. The work should be well closed round the stone, to prevent the tin and quicksilver contained in the socket from being shaken out by any violence. The lustre of stones set in this manner will continue longer then when they are set in the common way, as, the cavity round them being filled, there will be no passage found for moisture, which is so injurious to the wear of stones treated in any other way. This kind of foil likewise gives some kind of lustre to glass or other transparent matter which has little of itself; but to stones or pastes that have some share of play, it gives a most beautiful brilliance.

Two methods have been invented for colouring foils, the one by tinging the surface of the copper of the colour required by means of smoke, the other by staining or painting it with some pigment or other colouring substance. The colours used for painting foils may be tempered with either oil, water rendered duly viscid by gum-arabic, size, or varnish. When deep colours are wanted oil is most proper, because some pigments become wholly transparent in it, as lake or Prussian blue. The yellow and green may be better laid on in varnish, as these colours may be had in perfection from a tinge wholly dissolved in spirits of wine, in the same manner as in the case of lacquers; and the most beautiful is to be produced by distilled verdigris, which is apt to lose its colour and turn black with oil. In common cases, however, any of the colours may be, with the least trouble, laid in isinglass size in the same way as the glazing colours used in miniature painting.

For red, when the ruby is to be imitated, a little lake used in isinglass size, carmine or shellac varnish, is to be employed, if the glass or paste be of a full crimson, verging towards the purple; but if the glass incline to the scarlet or orange, very bright lake (that is not purple) may be used alone in oil.

For garnet red dragon's blood dissolved in seed lac varnish may be used, and for the vinegar garnet the orange lake tempered with shellac varnish will be found excellent.

For the amethyst, lake, with a Prussian blue, used with oil, and very thinly spread on the foil, will completely answer the purpose.

For blue where a deep colour or the effect of the sapphire, is wanted, Prussian blue that is not so deep should be used in oil, and it should be spread more or less thinly on the foil according to the lightness or deepness of the colour required. For the eagle marine, common verdigris, with a little Prussian blue, tempered in shellac varnish.

Where a full yellow is desired, the foil may be coloured with a yellow lacquer, laid on as for other purposes; and for the lighter colour of topazes, the burnish and foil itself will be sufficiently strong without any addition.

For green, where a deep hue is wanted, the crystals of verdigris, tempered in shellac varnish, should be used; but where the emerald is to be imitated, a little yellow lacquer should be added to bring the colour to a truer green, and less inclining to the blue.

The stones of more diluted colour, such as the amethyst topaz, vinegar garnet, and eagle marine, may be very cheaply, imitated by transparent white glass or paste even without foils. This is done by tempering the colours above enumerated with turpentine and mastic, and painting the socket in which the counterfeit stone is to be set with the mixture, the socket and stone itself being previously heated. In this case, however, the stone should be immediately set, and the socket closed upon it before the mixture cools and grows hard. The orange lake above mentioned was invented for this purpose, in which it has a beautiful effect, and is used with great success by many manufacturers. The colour it produces is that of vinegar garnet, which it affords with great brightness. The colours before directed to be used in oils should be extremely well ground in oil of turpentine and tempered with old neat or poppy oil; or, if time can be given for their drying with strong fat oil, diluted with spirit of turpentine, which will give a fine polish of itself. The colours used in varnish should be likewise thoroughly well ground and mixed; and in the case of the dragon's blood in the seed lac varnish and the laquer, the foils should be warmed before they are laid out. All the mixtures should be laid on the foil with a broad soft brush, which must be passed from one end to the other, and no part should be crossed, or twice gone over; at least not till the first coat is dry, when a second coat may be applied if the colour of the first is not pronounced enohug.

BOOK NOTICES.

Silversmith's Handbook. By George E. Gee. (London: Crosby, Lockwood, & Co., 7, Stationers' Hall Court, Ludgate Hill. 1877.)

This work forms a valuable sequel to the author's "Practical Gold Worker," and supplies a want long felt in the silver trade. It will be found a thoroughly practical treatise on the alloying and working of silver, including the different modes of refining and melting the metal; its solders; the preparation of imitation alloys; methods of manipulation; prevention of waste; instructions for improving and finishing the surface of the work; together with other useful information and memoranda. The author has endeavoured to make the subject intelligible, not only to manufacturers, but also to workmen and apprentices, and we feel sure that it will give satisfaction to all. Numerous illustrations are dispersed throughout the book, and assist materially in rendering the subject easy of comprehension.

English and German Editions of Saunier's Treatise on Horology.

This justly celebrated work, containing valuable information on all questions of interest on the subject of Horology, and valuable alike both to the manufacturer and jobber, is being translated and published in English, in monthly parts, the translation being undertaken by Mr. J. Triplin, Besançon, watch manufacturer, and Mr. E. Rigg, M.A., assayer in the Royal Mint. The translation will be welcomed, and, doubtless, eagerly sought after by students, experienced horologists, and workmen, to all of whom it must prove invaluable.

The work, with all the original woodcuts and coloured plates, will be published in twenty-six monthly parts, at 1s. 6d. each, and sent post free at 1s. 7d. Orders for the work may be sent to the translators direct, or transmitted through the office of this journal.

A German edition of the same work is in course of translation by M. Grossman, watch manufacturer, in Glasshûtte, in Saxony, and may be ordered through Mr. H. Bush, publisher's agent, Mytongate, Hull, or through this office.

TRADE RECIPES, &c.

Reducing Silver in the Wet Way.—Every chemist is familiar with the reduction of chloride of silver in the form of powder by means of metallic zinc in the presence of a little free acid. It is not easy to bring two such substances as the silver salt and the metal into close contact, and after the work is accomplished the removal of the excess of zinc has its difficulties. Dr. Grager suggests a modification of the old method that ought to be more generally made known. The chloride of silver is dissolved in ammonia and poured into a well-stopped bottle, and into this is introduced an excess of metallic zinc, in not too small fragments, so that any reduced metal adhering to it may be readily washed off. The decomposition begins immediately and is rapidly accomplished, especially if the contents of the flask be well shaken up. Three hours will suffice to reduce one quarter of a pound of chloride of silver. It is easy to ascertain when the reduction is ended, by testing a portion of the ammoniacal solution with hydrochloric acid. As soon as no cloudiness or curdy precipitate is formed, the work may be regarded as completed. A slight excess of ammonia is said to be favourable. The reduced silver must be washed with water until all odour of ammonia has disappeared. The pieces of zinc are removed by pouring the contents of the flask through a funnel, the opening of which is too narrow for the passage of the zinc fragments, while the reduced silver can be easily washed through. The finely divided silver can be digested in hydrochloric acid to restore it to a pure white colour, and it is then ready for solution or fusion, and will be found to be perfectly pure. In dealing with large quantities it would be economical to recover a portion of the ammonia by distillation. In the same way an ammoniacal solution of nitrate of silver can also be reduced by zinc, and the silver obtained pure, even when the original solution of the nitrate contains copper, provided a small quantity of silver be kept in the bath. It is better where copper is present not to take all of the zinc that may be requisite for the reduction of the silver. It will prove a great convenience to be spared the necessity of converting the silver into the chloride, as it is no easy task to wash out this salt on filters, and it will be found to be applicable to alloys which do not contain more than 25 per cent. of silver.—*Journal of Applied Chemistry.*

An Easily Made Cell.—The American "Journal of Microscopy" gives the following excellent recipe for constructing cells:—"A cell which we have found very durable, easily and quickly made, and very neat, is constructed as follows: Having procured some good gold size and pure litharge, grind the latter to a very fine powder. Mix the litharge and the gold size to the thickness of cream, and colour either black or dark olive by adding lamp black. With this paint, as it may be called, make as many cells as are wanted, and when made dust finely-powdered litharge over them until they are covered a sixteenth of an inch deep; allow them to stand a few minutes, and then shake off all the loose litharge by means of a few smart taps. The surface of the cell will now be quite rough. Allow it to stand a few hours, and then press it against a plate of glass. If this be done carefully, a smooth, solid ring will be left on the slide. If the edges are not as smooth as they ought to be, it is easy to trim them off on the turn-table by means of a small chisel. Such cells, after a few weeks, become very hard, and may be finished so as to be very neat. For dry objects they leave nothing to be desired, and as we have had them in use for over five years, we can speak as to their durability. For objects mounted in liquids it will be necessary to coat them with suitable varnish. Thus, for saline liquids, a coating of gold size renders them perfectly impervious. For glycerine use Bell's cement, or a solution of shellac in alcohol.

THE
Watchmaker, Jeweller, & Silversmith,
A MONTHLY TRADE JOURNAL,

Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at MILNERS' BUILDINGS, MOORGATE STREET (OPPOSITE MOORGATE STREET STATION), LONDON, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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Cheques and Post-office Orders to be made payable to A VICTOR, at Lombard Street Post Office.

ELASTICITY OF METALS AT DIFFERENT TEMPERATURES.

SIG. G. PISALI, an eminent physicist, communicates to a foreign chemical journal the results of a number of experiments on the above subject. From his researches it would appear that the elastic state of wire, within given limits of temperature, presents two distinct periods. In the first the total number of oscillations and the modulus of torsion at a fixed temperature gradually increase, whilst the duration of successive oscillations varies in a somewhat irregular manner, and the wire, when it comes to rest, is permanently in a sensible state of torsion. On continuing the oscillations at various temperatures between the fixed limits, however, the wire gradually passes into a definite normal state for the given limits of temperature in which these irregularities disappear. If the temperature be then raised higher than the former limit, the wire passes again into a variable state, which only becomes normal after long-continued oscillation. A change in the weight of the counterpoise, or a suppression of the tension for a short time, also alters the elastic state of the wire, which becomes normal only after frequent repetition of the changes in the conditions of experiment with long-continued oscillation. From this it will be seen that the determination of the constants, which refer to elasticity of torsion of the first and second order and the law of Coulomb itself, should be made with wires in a normal elastic state. The application of this to instruments of precision in which the torsion of metallic wires is employed is self-evident.

Great theoretical interest attaches to the phenomena of elasticity of the second order, for if this force is really due to friction between the molecules, of which bodies are composed, it must have some relation to the form of the molecules, and the study of the phenomena it produces may lead to a knowledge of a relation between the physico-mechanical structure, and the chemical quantivalence of the elements.

DESIGNS FOR PLATE.

AS will be seen by an advertisement in another page, the drawings submitted in competition for the prizes offered by the Goldsmiths' Company for designs for plate, are now on exhibition at the Architectural Museum, Westminster.

PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

80. WILLIAM MORGAN-BROWN, of the firm of Brandon and Morgan-Brown, Engineers and Patent Agents, of 38, Southampton Buildings, London, and 1, Rue Laffitte, Paris, for an invention of "Improvements in regulator clocks, in the mechanism for transmitting time from the same to distant indicating dials, and in the receiving mechanism imparting motion to the hands of such dials."—A communication to him from abroad by Edward James Muybridge, of San Francisco, United States of America.—(Complete Specification.)—Dated 5th January, 1878.

90. CHARLES RIBALLIER, of Paris, in the republic of France, Jeweller, for an invention of "An improved process of decolouring 'coloured diamonds.'"—(Complete Specification.)—Dated 7th January, 1878.

112. CLOTILDE HUBERT, of Brussels, in the kingdom of Belgium, Manufacturer of Jewellery, for an invention of "Improvements in bracelets and necklaces."—Dated 9th January, 1878.

142. THOMAS SHAW, of Birmingham, Tool Maker, and FREDERICK ARTHUR WALTON, of Birmingham, Jeweller, for an invention of "An improvement in shirt-studs, sleeve-links, and similar articles."—Dated 11th January, 1878.

317. LUIGI PERONI, of 45, Hatton Garden, Holborn, in the county of Middlesex, Glass Blower, for an invention of "Improvements in the construction and formation of glass tubes employed in the manufacture of thermometers and in the manufacture of thermometers therefrom, which said tubes are more especially applicable to the manufacture of clinical, chemical, and other like thermometers."—Dated 24th January, 1878.

Notices to Proceed.

4799. JAMES BROCKIE, of Canonbury, in the county of Middlesex, has given notice in respect of the invention of "New or improved apparatus for synchronising clocks."

80. WILLIAM MORGAN-BROWN, of the firm of Brandon and Morgan-Brown, Engineers and Patent Agents, of 38, Southampton Buildings, London, and 1, Rue Laffitte, Paris, has given notice in respect of the invention of "Improvements in regulator clocks, in the mechanism for transmitting time from the same to distant indicating dials, and in the receiving mechanism imparting motion to the hands of such dials."—A communication to him from abroad by Edward James Muybridge, of San Francisco, United States of America.

Grants of Provisional Protection for Six months.

4904. To ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for the invention of "An improved universal time-piece or geographical clock."—A communication to him from abroad by William Asro Cates, of Union, in the county of Union, and State of Oregon, United States of America.

Inventions protected for six months in the Deposit of Complete Specifications.

80. WILLIAM MORGAN-BROWN, of the firm of Brandon and Morgan-Brown Engineers and Patent Agents, of 38, Southampton Buildings, London, and 1, Rue Laffitte, Paris, praying for Letters Patent for the invention of "Improvements in regulator clocks, in the mechanism for transmitting time from the same to distinct indicating dials, and in the receiving mechanism imparting motion to the hands of such dials,"—a communication to him from abroad by Edward James Muybridge, of San Francisco, United States of America,—was deposited and recorded in the Office of the Commissioners on the 5th day of January, 1878, and a complete Specification accompanying such petition was at the same time filed in the said office.

90. CHARLES RIBALLIER, of Paris, in the republic of France, Jeweller, praying for Letters Patent for the invention of "An improved process of decolouring 'coloured diamonds,'" was deposited and recorded in the Office of the Commissioners on the 7th day of January, 1878, and a complete Specification accompanying such petition was at the same time filed in the said office.

Patents Sealed.

2879. ALBERT BARKER, of Daphne Terrace, Turnham Green, in the county of Middlesex, Dressing Case Maker and Silversmith, and RICHARD QUIN, of Poland Street, in the said county, Jewellery Case Manufacturer, for an invention of "Improvements in opening and closing arrangements, applicable to cases, boxes, toilet-tables, cabinets, secretaires, and other like articles having winged or side openings."—Dated 27th July, 1877.

2837. GEORGE HENRY BRICKNELL, of Birmingham, in the county of Warwick, Jeweller, for an invention of "Improvements in fastenings for buttons, shirt studs, solitaires, and other articles of jewellery and dress."—Dated 25th July, 1877.

Patents which have become void.

56. Mortimer George Cole, of Belvedere House, Bexley Heath, in the county of Kent, for an invention of "Improvements in watches and time keepers."—Dated 10th January, 1871.

Patents Granted in Foreign States.

Belgium.

43,601. A. Lion, a Patent of improvement for "A bracelet."—Dated 23rd November, 1877.— (Original Patent, 2nd August, 1877.)

43,691. A. Lejeune, for an imported invention of "Spring fastenings for bracelets, rings, &c."—Dated 3rd December, 1877.—(French Patent, 30th November, 1877.)

43,675. E. Dubois, of Brussels, for "Spiral bracelets."—Dated 1st December, 1877.

43,728. R. Speltz, for "Fastenings for ear-rings."—Dated 8th December, 1877.

43,813. A. Lefebvre and H. E. Bart, for an imported invention of "Machinery for the manufacture of double buttons (studs)."—Dated 19th December, 1877.—(French Patent, 17th December, 1877.)

43,849. A. Hubert and Co., for "A bracelet."—Dated 24th December, 1877.

43,896. G. Zanni, for an imported invention of "An electric apparatus for clock-bells."—Dated 29th December, 1877.—(French Patent, 28th December, 1877.)

German Empire.

5,289. Wirth and Co., of Frankfort-on-the-Maine, for A. Frankfeld, of Geneva, for "A watch-motion."—Dated 27th December, 1877.

250. A. E. Müller, of Wolfsgraben, near Vienna, for "A chronometer with compensation."—Dated 5th August, 1877.—Class 83.

United States of America.

195,490. John J. Crooke, of Southfield, N.Y., for "Manufacture of tin-foil."—Application filed 24th May, 1877.

195,542. Donald D. Smith, of Rock Fall, Conn., for "Watch-keys."—Application filled 19th June, 1877.

195,622. Azel S. Lyman, of New York, N.Y., assignor to himself and Watts, Parker, and Co., of the same place, for "Soldering apparatus."—Application filed 21st June, 1877.

195,629. F. H. Moore, of Boston, Mass., for "Eyeglass-supporters."—Application filed 9th June, 1877.

195,687. W. H. Zinn, of Boston, Mass., for "Watch-winding devices." Application filed 31st July, 1877.

195,711. Otis Hoyt, of Springfield, Ill, for "Dust-bands for watches." —Application filed 24th July, 1877.

195,765. H. G. Mackinney, of Providence, R.I., for "Gem-settings."—Application filled 10th February, 1877.

196,077. Jelle A. de Vries, of Pella, Iowa, assignor of one-half of his right to A. Kruidenier, of the same place, for "Jewellers' lathes."—Application filed 15th August, 1877.

169,180. S. William Babbitt, of West Meriden, Conn., assignor to the Wilcox Silver Plate Company, of the same place, for "Covered articles of plated ware."—Application filed 2nd October, 1877.

196,228. Caleb Hopkins, of Waltham, Mass., for "Watch-makers' lathes."—Application filed 21st September, 1876.

196,252. Henry M. Robcttom, of Liverpool, Great Britain, assignor of one-third of his right to William P. Thompson, of the same place, for "Stem winding and setting watches."—Application filed 18th August, 1877.

196,314. Wm. A. Sturdy, of Norton, Mass., for "Metallic tassels for jewellery."—Application filed 17th August, 1877.

196,375. Thomas H. Mott, of New York, N.Y., for "Calendar clocks." —Application filed 17th August, 1877.

196,609. Detlef C. Voss, of New York, N.Y., assignor to himself and E. A. F. Wachter, of the same place, for "Watch-case springs."—Application filed 29th September, 1877.

196,702. Almon B. Richmond, of Meadville, Pa., for "Clock-pendulums." —Application filed 16th March, 1877.

196,726. Lansing Van Doren, of Washington, D.C., for "Dial-fastenings for watches."—Application filed 12th April, 1877.

Designs Patented.

10,265. Harvey Lang, of Kennett's Square, Pa., for "A bracelet."—Application filed 28th May, 1877.—Term of patent 3½ years.

10,277. Watson J. Miller, of Chicopee, Mass, assignor to E. G. Webster and Brother, of New York City, for "A dessert-set."—Application filed 2nd October, 1877.—Term of patent 7 years.

10,288. Louis Heckmann, of Plainville, Mass., assignor of two-thirds of his right to Wm. H. Wade and Edwd. P. Davis, of the same place, for "Ornamental scroll-work for jewellery."—Application filed 25th August, 1877.—Term of patent 7 years.

Re-Issues.

7,911. John S. Birch, of New York, assignor, by mesne assignments, to W. A. Cummings and C. C. Cummings, of Brooklyn, N.Y., for "Adjustable watch keys."—Patent No. 70,787, dated 12th November, 1867.—Application filed 6th September, 1877.

France.

118,204. Osselin, for "Electric rings, bracelets, and collars."—Dated 24th April, 1877.

118,241. Hodent, for "A stereoscope."—Dated 26th April, 1877.

118,245. Carollet, of Avignon, for "A clock with a simplified free and spring escapement, and chronometric action."—Dated 5th April, 1877.

118,302. Berthet, of Levallois-Perret, for "White metal called 'Nickeline.'"—Dated 30th April, 1877.

118,359. Weit, Nelson, and Pic, for "Applying molten glass and enamel on rods, for the manufacture of mourning or fancy jewellery, attire, and ornaments for fashion."—Dated 3rd May, 1877.

118,474. Haas, jun., and Co., for "A perpetual date apparatus for watches, clocks, and other clockwork."—Dated 9th May, 1877.

118,505. Theodore, of Paris, for "A mysterious clock."—Dated 3rd May, 1877.

118,508. De Combettes, of Paris, for "A maximum and minimum thermometer and index."—Dated 12th May, 1877.

118,522. Lelievre and Muleur, Brothers, for "Processes and apparatus for the manufacture of products imitating polished steel with facets."—Dated 12th May, 1877.

118,558. Ognard, for "Watches with grand fixed seconds and a single wheel-work."—Dated 15th May, 1877.

118,569. Droz-Jeannot, jun., for "A remontoir applicable to all watches."—Dated 16th May, 1877.

118,698. David Vaudey, for "A clock and its stand."—Dated 26th May, 1877.

118,721. Menage, of Paris, for "Studs for shirts and cuffs."—Dated 28th May, 1877.

Certificates of Addition granted in France.

112,048. Bequelin, for "A stop for the spring-boxes of watches, &c." —Dated 5th April, 1877.

115,725. Hessel, for "A wet way of treating oxydated nickel-ore."—Dated 29th March, 1877.

106,026. Malfait, for "Clocks with moving figures."—Dated 29th March, 1877.

116,407. Sebillot, for "Metallurgy of nickel."—Dated 10th April, 1877.

117,684. Amiet for "A remontoir watch."—Dated 21st April, 1877.

113,086. Jaubert, for "Optical apparatus."—Dated 17th April, 1877.

113,214. Griffon, for "Safety watch-cases."—Dated 20th April, 1877.

115,663. Lion, for "A bracelet."—Dated 23rd April, 1877.

59,068. Hudelot, for "A machine for making potences of watches." —Dated 26th April, 1877.

114,811. Rolet, for "Compass watches."—Dated 12th May, 1877.

112,721. Gondolo and Callier, for "Rectilinear compensating balances for chronometers."—Dated 5th May, 1877.

116,790. Francois, for "An alarm for winding clocka."—Dated 12th May, 1877.

113,502. Cadot, for "A mysterious clock."—Dated 15th May, 1877.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Holt, Robert Burbank, 141, Newington Causeway, and 3, Bank Buildings, Upper Norwood, jeweller. Dec. 22. T. F. Allingham, sol., 55, Old Broad-street.

Good, John, Thames-street, Windsor, jeweller. Jan. 4. C. T. Phillips, sol., 7, Gray's Inn Square.

Myer, Henry, 37, Mildmay-street, Islington, jeweller. Dec. 29. Lewis & Lewis, sols., 10, Ely Place.

Treleaven, Walter, Cornwall-street, Plymouth, jeweller. Jan. 3. C. Rodda, sol., Plymouth.

Follis, Thomas, Burbury-street, Aston Manor, near Birmingham, and Wharstone-buildings, Birmingham, jeweller. Jan. 11. E. Jaques, sol., 40, Cherry-street, Birmingham.

Perkins, Robert Andre, 35, Northampton-street, Birmingham, jeweller. Jan. 8. J. C. Fowke, sol., Birmingham.

Vernon, Henry, jun., Alnwick, Northumberland, watchmaker, and jeweller. Jan. 7. Forster & Paynter, sols., Alnwick.

Aprile, Joseph & Napoleon, trading as J. & N. Aprile, Hamlet and Ballingdon-street, Sudbury, silversmiths, &c. Jan. 7. A. Prior, sol., Colchester.

Ascoli, Augustus, 4, Commerce-road, Wood Green, watchmaker. Jan. 16. T. A. Romer. sol., 88, Chancery Lane.

Bushnell, Charles James Henry, trading as C. Bushnell & Co., 21½, Snape-street, Birmingham, jeweller Jan. 18. R. M. Wood & Son, sols., Waterloo-street, Birmingham.

Long, Henry, jun., 13, Princes-street, Leicester Square, watchmaker. Jan. 11. H. A. Hanrott, sol.

Norris, Jabez Henry, and Walter Alfred Norris, Market-street, Manchester, jewellers. Jan. 18. At Queen's Hotel, Birmingham, in lieu of place originally named, Feb. 5 at 3.

Asher, Jacob, 81, Stocks-st., Cheetham, Lancashire, travelling jeweller. Jan. 23. At R. Hankinson's, sol., John Dalton-st., Manchester, Feb. 8 at 3.

Campbell, Thos., trdng. as Jno. Campbell, 7, South Castle-st., Liverpool, watchmaker. Jan. 26. At T. Etty's, sol,, 22, Lord-st., Liverpool, Feb. 18 at 2.

Child, Algernon Sidney, 72, Bark-st., Bolton, watchmaker. Jan. 25. At W. Scowcroft's, sol, Bolton, Feb. 14 at 10.

Eisenstein, Latzer, trdg. as Louis Eisenstein, 41, Mortimer-rd., Kingsland, dealer in precious stones. Jan. 23. At Goldberg and Langdon's, sols,, 1, West-st., Finsbury Circus, Feb. 13 at 3.

Higgs, Ernest Wm., Sandown, Isle of Wight, jeweller. Jan. 22.

Norris, Jabez Henry, & Walter Alfred Norris, trdg. as J. & W. Norris, 62, Market-st., Manchester, manufacturing jewellers. Jan. 21. At Queen's Hotel, Birmingham, Feb. 5 at 3. Horner & Son, sols,, 3, Clarence-st., Manchester.

Norris, Jabez Heny., Collyhurst-rd., Manchester, manufacturing jeweller (sep. estate). Jan 21. At Queen's Hotel, Birmingham, Feb. 5 at 3½. Horner & Jon, sols,, 3, Clarence-st., Manchester.

Norris, Walter Alfd, Cuthbert-st., Rochdale-rd., Manchester, late Brighton, manufacturing jeweller (sep. estate). Jan 21. At Queen's Hotel, Birmingham, Feb. 5 at 4. Horner & Son, sols,, 3, Clarence-st., Manchester.

Dissolution of Partnerships.

Braham & Bradshaw, 142, Southampton Row, opticians. Dec. 12.

Girdlestone & Lewinsky, 15, Frith-street, Soho, manufacturing jewellers. Dec. 31. Debts by William F. Girdlestone.

Hazelton & Clark, Icknield-street East, Birmingham, jewellers. Jan. 1.

Mason & Green, 49, Lower Hockley-street, Birmingham, manufacturing jewellers. Dec. 31.

Swasbronk & Beesley, Church-street, Birmingham, gold wedding ring manufacturers. Dec. 31. Debts by W. Swasbrook.

Frodsham, Chas. & Co., 84, Strand, chronometer, watch, and clock makers. June 30. Debts by Harrison M. Frodsham.

Lloyd, Payne & Amiel. Thomas-street, and High-street, both Manchester, jewellers. Jan. 10. As regards Charles E. C. Lloyd.

Adjudications of Bankruptcies.

Pumfrey, Jno. Hillman, Northampton-street, Birmingham, manufacturing jeweller. Jan. 3.

Chambers, George, trdg, as Wm. Chambers and Son, 18, Powell-st. East, St. Luke's, watchmaker. Jan. 22. At Bktcy. Ct, Lincoln's Innfields, Feb. 6 at 12½. Hazlitt, Reg.

Trustees Appointed.

Chalmers, John, High-street, Montrose, watchmaker. W. Ross, Montrose, solicitor.

Dale, Wm. (Liq.), Watford, jeweller. W. C. Harvey, 1, Gresham buildings, Bashinghall-street, accountant.

Turpin, Robt. T. (Liq.), Tynemouth and Newcastle, jeweller. Tr., E. Lewing, Gray-street, Newcastle, accountant.

Dividends under Sequestrations.

Meek, John, Buchanan-street, Glasgow, dealer in clocks, &c. 1st, Miller & Ferguson's, 71, Queen-street, Glasgow, on and after Jan. 31.

Sutherland & Thomson, Glasgow, jewellers. Equalizing & 2nd and final on Co.'s, & 1st and final on W. R. Sutherland's. W. D. Quick's, 75, Bath-street, Glasgow, on and after Feb. 1.

Barker Wm. (Liq.), 164, New Bond-st., jeweller. 4th div. 9d.; H. H Ashworth, 3, Copthall-bdings., accountant.

Applications for Discharge.

Jacob, Aaron, 63, Renfield-street, Glasgow, wholesale jeweller. Jan. 14.

Trust Deeds Granted in Scotland.

Marr, James, jun., Edmond-st., Dennistown, Glasgow, watchmaker and jeweller. Clms. with John Wilson, 59, St. Vincent-st., Glasgow, C.A. by Feb. 23.

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Illustrirte Fachzeitschrift fur Uhrmacher.
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Deutsche Uhrmacher Zeitung,

ORGAN DES CENTRAL-VERBANDES DER DEUTSCHEN UHRMACHER.

Expedition; BERLIN, W. MARKGRAFENSTRASSE, No. 48.
R. STACKEL, HOF UHRMACHER.

This popular German periodical appears fortnightly, and may be had, post-paid, for 2s. per quarter, and 7s. per annum. Single Copies, 6d. Advertisements are charged at 3d. per four-parted line. The Journal is noted for really practical and scientific articles, and abounds with information concerning the requirements in the Art and Trade of Watchmaking. The great circulation of the same amongst Watchmakers in all parts of Germany and German Watchmakers abroad, secures for advertisements the best possible effect. Orders for Subscriptions and Advertisements, at Original Prices, carried out for Great Britain and Colonies—H. Bush's Publishers' Agency, Hull, Yorkshire; and for the United States—H. Horend, 186, East Broadway, New York.

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THE
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JEWELLER.
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TRADE
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W H TILBY

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HOROLOGY.

(*Continued from page* 147.)

XXXII.—Its Relations to Astronomy.

By G. B. Miller.

To comprehend the real importance of the effect of refraction on the results of an astronomical observation, we must take into consideration the fact stated in our last number, that the density of the atmosphere is not uniform, and therefore the line described by a ray of light will not be in the arc of any given circle; it would describe a circular path, but each arc is the part of a circle having a very different radius from any of the others in the same path. It has been found that an object 10° above the horizon will be refracted in its approach to the zenith very nearly as the tangent of the angular distance from that point. The constants for refraction are varied, however, in a more marked degree by the conditions of the air, as shown by the barometer and thermometer: thus the quantity of refraction at equal distance from the zenith varies nearly as the height of the barometer, assuming the temperature to be constant, which it never is, and the effect of the variation is in all cases to diminish the refraction by 480th of its true value for every degree of increase in temperature. The sole effect of refraction is exerted in the meridian, therefore in transit observations it may be entirely neglected; but where time is taken by means of altitudes, the allowance must be made, and in all astronomical observations the results are not considered reliable below 15° of the horizon.

The laws governing the source of so much error were investigated by Dr. Bradley, who formed a set of tables. He observed the zenith distances of the sun at his greatest declination, and also the zenith distances of the pole-star at its greatest meridian elongations, and added the four quantities, which must be equal to 180° minus the amount of the four refractions. Taking their zenith as 0°, and having a base, it was easy to assign the law of the variation by theory. Thus the mean horizontal refraction he found to be=35′ 6″, while at the altitude of 45° it is only 58″ 36. The effect of refraction in observations was noticed by Ptolemy as early as the second century, but astronomy was then not equal to the task of determining the true value.

Upon the property of light thus called refraction depends the whole value of astronomical instruments, in all of which the lens comes into use either for the observations of a celestial body itself, or for reading off the distances indicated by the instrument. The laws of refraction, insomuch as they are applied in the construction of such instruments, hardly need be explained here, as in a subsequent chapter all that need be said will be in connection with the transit and quadrant. There is a subject connected with refraction, however, that is a fine illustration of the reasoning used in astronomical research. If we allow a ray of light to pass through a prism of glass we will find, on letting it fall on a sheet of white paper, that instead of there being a round spot of white light, a parallelogram is formed, not of white light, but composed of colours in the following order :

Red,
Orange,
Yellow,
Green,
Blue,
Indigo,
Violet.

The image they cast on the white screen is called the spectrum; the form of which, its size, and the peculiar relation of the space occupied by the different colours, are destined to become very important agents for discovery in astronomy, as, from considerations founded upon the spectrum, it is believed that the materials of which the sun is formed may yet be analysed, and the constitution of his whole body be nearly determined. The decomposition of light is of importance, as it has been found that the spectrum is affected, not only by the angle, but by the material, and this knowledge is taken advantage of in order to render the object-glass of the telescope capable of refracting a ray of pure white light at high magnifying power. Were the two segments of a sphere which joined together to be made of one kind of material only, it would be impossible for the eye to receive the image of an object without its being surrounded by coloured fringes that would render the definition very confused. Now if two glasses of different refractive power are placed together in order to form one lens, the rays that have been decomposed by the biconvex lens are recomposed by the other, thus enabling the eye to get a ray of natural light. These glasses are called achromatic, from the fact that they give no accidental colours to the objects viewed. The decomposition of white light was one of the highest efforts of Sir Isaac Newton's mathematical mind: his genius not only discovered the law of refraction, but enabled him by actual experiment to measure the length of the different coloured rays. He had observed that the pellicle of a soap bubble gave all the colours of the prism, and the question came up—why? In pondering on the subject he decided that it was owing to its thickness; and it will occur to every one who has in his boyhood used a clay pipe and soft soap in solution, that he found the drop at the lower side of the bubble to give a red ray, while in the centre it would be violet. It was while using this very simple apparatus in his investigations that a frequent passer-by, seeing Newton busily engaged in blowing soap bubbles, asserted that no one but a fool or lunatic could amuse himself in such a frivolous way. But the pursuit was too far above the comprehension of the spectator, and we can only imagine what his astonishment would have been had he been convinced that the blowing of soap bubbles was in future to give a correct definition of the laws of light. In observing the different colours in the thin film of soap and water, he was led to connect the fact with the dispersion of the rays by means of a prism; he had a clue to the colour, but why should the different rays be given by reflection? Newton could only assign, what has since been substantiated, that the colour depended on the thickness of the film. Now, it will be obvious that the sides of a soap bubble are thinner than the bottom, where, by the force of gravity, the greatest amount of material is collected. We must first premise that in the reflection one part of the ray is from the exterior surface, the other from the interior: if, then, the thickness of the film was a fractional part of a supposed undulation, no light would be seen—a black spot, or ring, only being obtained. If, then, we assume a wave of any certain coloured light, say red, to be equal to x, then at any part of the film that also is equal to x in integral numbers we should have only red light reflected, as no other coloured ray has the same value. By the following table it will be seen that the undulation of the extreme violet is the shortest, and extreme red the longest.

TABLE OF DIMENSIONS OF UNDULATIONS.

Colour.	Length of Undulations in parts of an inch.	Number of Undulations in an inch.	Number of Undulations in a second.
Extreme Red.........	0,0000266	37640	458,000,000,000,000
Red......................	0,0000256	39180	477,000,000,000,000
Orange	0,0000240	41610	506,000,000,000,000
Yellow	0,0000227	44000	535,000,000,000,000
Green	0,0000211	47460	577,000,000,000,000
Blue......................	0,0000196	51110	622,000,000,000,000
Indigo..................	0,0000185	54070	655,000,000,000,000
Violet	0,0000174	57090	699,000,000,000,000
Extreme Violet	0,0000167	59750	727,000,000,000,000

Newton had not this table of measurement, but he furnished the means by which it was computed. Thus, if a plane is supposed to touch a sphere, it can come in contact at only one point; from this point the distances between the sphere and plane will be in some relation to the diameter of the sphere. We shall have the distances between the plane and sphere constantly increasing in some ratio that we may easily determine, if we know the radius of the sphere. Arguing in these premises, Newton placed a plane of glass on a lens, and found in the centre, as he had anticipated, a black spot, owing to the interference of the rays. Now, if between the two glass surfaces there should be a distance that was an even measure of any wave of coloured light, that colour will be shown at the spaces that are equal or in an even ratio, say 1, 2, 3, etc.; but at the space which is a fractional part of the wave, the ray of light will disappear from interference, and a black ring will be formed. The experiment is simple, and any one can try it. The effects are more striking if a ray of homogeneous light is used. The reason why the ring is of an increased brilliancy is owing entirely to the fact that the eye receives the wave, doubled as it were on itself; that is, with an equal motion the wave must meet the eye at the same time that the lens-reflected ray has. But it must be remembered that the wave will arrive just 1, 2, 3 behind the wave that reaches the eye from direct reflection; but as it corresponds in time, the light is clear and definitely impinged in the retina. But if the distance is such as to render the refracted wave fractional to the other, an interference in the lengths of the wave would take place; that is, a part of the wave would overlap a part of another, and thus destroy any light that falls on the spot. Knowing the focus of the lens, we can easily ascertain the lengths of the wave from their colours. The exceeding minuteness of such quantities is an apparent bar to one's studying the subject, yet it is within the comprehension of any one who can reason. Before we part with the subject of colour we may state the very interesting fact, that in the spectrum we have mentioned there are rays emanating from the sun, not visible to the eye; and the whole success of photography depends on the rays that are not shown in the spectrum.

These are called actinic rays, and their effects may be observed in many other ways than in the strictly photographic processes—say in the crystallisation of camphor in the druggist's jar. Now we know that gum camphor will sublime and then condense; but were there no actinic rays, the vapour would condense equally on the sides of the jar, but it does not. The place of deposit will be found by any observer to be invariably in the line of the light; and this effect would be had were the jar to be so placed that the light does not fall on it; for if the actinic rays just beyond the visible spectrum are allowed to fall on the drug, this effect is produced; and again, in the photographic processes, there are rays used called chemical, that are interesting, but hardly within the province of Horology.

If we suppose a ray of light to emanate from any luminous body, and assume that that body and the observer's eye remain in the same relative positions, we trace this ray's path in a straight line; but from the effects of refraction it will be curved. In the case of an observation on a fixed star, only one of the positions is fixed. By the motion of the earth in its orbit the observer is continuously changing his relation to the object. If he is approaching, the object will be seen always a trifle in advance, while the contrary would hold were his course from the object. Now, if the telescope were directed to the star in a straight line with the ray, and parallel, the ray would fall on the side of the telescope, instead of directly on the line of collimation of the instrument. This is called aberration of light, and though small, an account of it has to be taken both in the observation and the subsequent computation. This demonstration of the aberration of light has confirmed the undulatory theory, and moreover established the fact that light is not instantaneous—that it takes an appreciable time for a ray to accomplish its passage.

This, one of the most beautiful propositions of Astronomy, was established by a Danish astronomer (Roemer) in 1675, and was first suggested to him by some very singular disagreements in the real and computed positions of Jupiter's moons. Galileo, by the use of his telescope, had discovered that the most magnificent planet of our system was attended by satellites. This discovery was of the highest importance to Astronomy; indeed, it forms an epoch, for it furnished a means for the astronomical determination of longitude—in other words, the determination of time.

(To be continued.)

THE TELEPHONE AS A TIME REGULATOR.

A CORRESPONDENT of an American contemporary suggests a fresh application of the principles involved in the telephone. It applies to the regulation of clocks to a standard time piece, and may be made local or general. His *modus operandi* is as follows:—

"Let the pendulum of regulator oscillate immediately above a permanent magnet wrapped with coils of insulated wire, the same as the telephone. Let the wires from this magnet form a circuit connecting other similar magnets placed one under the pendulum of each clock to be regulated. While each stroke of the regulator will affect its magnet, and thus induce a current, which in turn will affect the other magnets, the regulator itself will be equally affected by the other pendulums along the line, and the result would be a rate the mean of all the clocks.

"To obviate this the regulator must control the secondary pendulum without itself being influenced by it or the other clocks. This can be done in various ways. A simple one is by making and breaking the circuit of a local battery controlling the secondary pendulum. This secondary pendulum must induce sufficient magnetism to control the sum of that induced by all others along the line, and this will again be more or less, as the rates of the various clocks, or their mean rate, varies from the correct one."

VALUABLE COLLECTION OF PRECIOUS STONES.

AT the annual *conversazione* of the Birmingham and Midland Institute (which commenced on the 15th ulto.) was exhibited a splendid collection of agates, silicious and precious stones, belonging to Mr. William Bragge, F.S.A. The Birmingham *Daily Post* gives a free and very interesting discription of the valuable collection lent by Mr. Bragge, and we regret that want of space precludes our inserting the article *in extenso* in the present number of our journal, but hope to do so in our next issue.

JEWELLERS' SHOW-CASES AND WINDOW REQUISITES.

WINDOW dressing has become quite an art of late, and it is certain that a tasteful display of goods has the power of securing notice and attracting purchasers. If we look into the show window of a jeweller, we cannot fail to observe that a number of simple but ingenious appliances assist him in producing the pleasing effect which so strikes the eye of the public. Many of these effective and time saving contrivances have been devised and are manufactured by Mr. Wm. Potter, senior member of the well-known firm, Messrs. Potter & Sons, late of 109 and 110, Aldersgate Street. For over thirty years this firm has made it its business to study the requirements of the trade, and to indroduce improvements and novelties which have been essential in bringing about the present perfection in these indispensable articles. Great increase of business necessitated the use of larger premises, and a short time ago we had the privilege of inspecting their new establishment, the Excelsior Steam Works, at 136 and 137, Aldersgate Street.

The building, which was constructed especially for the trade under the personal supervision of Mr. W. Potter, consists of six large floors covering a space of between 16 and 1700 square feet. Lighting, heating, and ventilation are based on the most approved systems, and it is evident that the health and comfort of the employés have been as much considered as the conveniences of business. All the printing is done on the premises, and the basement is set aside for this department, including lithography and copper-plate printing. Part of it has, however, been appropriated for packing purposes, and to judge by the number of packages ready for delivery at the time of our visit, it seems as if the general depression of trade had not found its way here. The ground floor is devoted to the general stock and counting house. All the arrangements here are admirable; but what struck us more particularly was a novel idea in displaying the numberless varieties of show-cards published by the firm. The various counters are made use of for this purpose, the cards being let in their front panels and covered with glass. The method is very effective, and saves not only the time usually spent in passing numerous patterns before the eyes of customers, but it also enables the latter to take in the whole at a glance, thus greatly facilitating his selection.

The first floor serves as show-room for counter show-cases and other jewellers' requisites, comprising an immense variety of stands, trays, cases, hooks of all description, cardboard boxes, jewellers' wool, etc., brackets, standard bars, and window fittings generally. The show cases, of which an ample stock is always at hand, are all warranted air-tight and of the latest and most improved description. Among the [extensive selection of jewellery cases some morocco work of handsome design and finish deserve special mention. We noticed also many novelties in the shape of stands for rings, etc., in French nickel, and so contrived as to make a most charming display without the least possible labour. Foremost among the various hooks is Mr. Potter's own "Patent Lock and Watch Hook." It is very simple, but it answers its purpose so well that whoever has tried it once is not likely to use another again. It shows and fixes the ticket well, can be adjusted to large and small ones, and is durable and inexpensive. The second floor is used for ticket-writing and drawing on stone, while the next floor has been converted into a paper store, and contains the cutting machines. The top floor is exclusively a store-room for duplicate stock. Every article of the firm is marked with a special number; and to give the reader an idea of the variety of the stock, we may state that there are close upon four thousand numbers. The arrangements are, however, so neat and systematic that any of these numerous articles may be laid hold of without the least trouble. This order and system is, however, not confined to the store-room, but is one of those pleasing features which pervade every department of this establishment.

ANTIQUE JEWELLERY AND ITS REVIVAL.

By Alessandro Castellani.

(Continued from page 155.)

Antique ornamental objects may be divided into two classes; namely, articles for daily use, and those for funeral purposes. The former are massive enough to be worn for years without suffering the slightest alteration, while the latter, destined for tombs, are exceedingly frail. We are astonished at the delicacy of workmanship, and often unable to imitate it. Both kinds belonging to the flourishing period of the goldsmith's art are of pure gold, but diminish in value as soon as they bear the character of certain Eastern importations, or represent designs which already point to the decadence beginning with the Roman Empire. Antique work widely differed, however, at all times from the present productions of Europe; and modern jewellery compared with antique is less artistic and more mechanic. The different technical processes, such as melting, engraving, enamelling, polishing, and stone-setting, are now divided among various workmen, and the whole is generally under the direction of a maker whose object is to turn out a saleable article, intended to catch the eye, and not to create a work of art. The precious metal employed in antique ornaments is, however, fully eclipsed by the beautiful workmanship, be they of Greek or Italian origin. The hand of the ancient artist, while bringing forth embossed figures and ornaments, or tracing with perfect symmetry the fine-lines of minute granulated and thread work, or flowers and meanders, was guided by the highest ability and taste. These different processes he combined with an ease enabling him to subdivide his work to the utmost without injuring the elegance and strict unity of his original idea. It appears that the ancient goldsmiths were acquainted with and made use of chemical and mechanical agents which are unknown to us; they could separate and join particles of gold of such extreme minuteness as to be scarcely visible to the naked eye. Our modern workmen have not yet attained this perfection and the modes of melting, soldering, and wire drawing of their ancient brethren remain still a mystery.

On examining Greek and Etruscan granulated work, we must confess that the ancients, independent of elegance of design and engraving, were vastly our superiors in this branch of art. Among the native Hindoos, we still find goldsmiths of the real antique type and leading a nomad life like their forefathers. They carry their tools with them and set to work wherever employment is offered. Sometimes they remain with a rich nabob or rayah, and with their customary perseverance, assisted by a small bellows and a few of the most primitive tools, they transform gold coins, after the old national tradition, into grainy filigree ornaments, which bear a striking resemblance to the antique productions. These Indian jewellers gave us an idea how the old Greek and Etruscan goldsmiths executed their work, and it is probable that the latter also worked with the greatest freedom, assisted only by few and inadequate tools, rather following their good traditions and never-failing taste, and that they were not only workmen but also artists.

After resolving the revival of the antique school, our first object was to discover the processes by which the ancients worked. We observed that their ornaments, except those intended for funeral ceremonies, instead of owing their raised parts to chisselling or engraving, were formed by separate pieces brought together, placed one upon the other, and fixed by soldering on some chemical manipulation. This, in my opinion, gives it so peculiar and marked a character, derived rather from the realization of the spontaneous idea and inspiration of the artist, than from the regular execution of the workman. Its very imperfections give to the workmanship that artistic character altogether wanting in the general number of modern works, which are usually produced by punching and casting, and that charm which so constantly strikes us in the work of the ancients. The first problem, then, that offered itself to our attention was the means of soldering together, with the utmost neatness and delicacy, so many pieces of extraordinary thinness. Among others, those of almost invisible grains, like little pearls, which play so important a part in the ornamentation of antique jewellery, presented difficulties nearly insurmountable. We made numerous assays, employing all possible agents, and the most powerful dissolvents to compose proper solder. We consulted the writings of Pliny, Theophilus, and Benvenuto Cellini, and neglected no other sources of instruction with which tradition could furnish us. We studied the works of Indian jewellers, and those of the Maltese and Genoese, but it was only in a remote corner on the Umbrian frontier, at St. Angelo, in Vado, a little district hidden in the recesses of the Apenines, far from every centre of civilization, that we still found in use some of the processes employed by the Etruscans.

There yet exists in this region of Italy a special school of traditional jewellery somewhat similar—certainly not in taste or elegance of design, but at least in method of workmanship—to the ancient art. The beautiful peasant girls of these districts when at their wedding feasts wear necklaces and long earrings called *naricelle*, much resembling the antique in workmanship. We then procured from St. Angelo, in Vado, a few workmen to whom we taught the art of producing Etruscan jewellery. Inheriting the patience of their forefathers, and caring nothing for those mechanical contrivances by which geometrical exactness is attained in modern jewellery, these men succeeded better than all whom we had previously employed, in the imitation of that freedom of style which is the peculiar characteristic of the art among the ancients. Among the workmen of St. Angelo we mention with pleasure the master of this traditional art, Benedetto Romanini, our first pupil.

The events of 1848 interrupted our researches: works of art were made to symbolise patriotism, and as we produced and sold many objects of that character, our models found their way over Italy and other countries. When, however, darker times settled over our country, these hopeful prospects soon vanished, and many causes, which we cannot here mention, obliged us to discontinue our labours. Bad times followed, and it was not before 1858 that we were enabled to recommence our task, and need scarcely mention that we took it up again with renewed vigour, and endeavoured by a revival of the old traditions and every other means in our power, to reclaim that high repute which Italian art once justly commanded. Etruscan, Greek, and Roman jewellery became again the chief subjects of our studies and of carefully executed imitations. On comparison it will be noticed that Etruscan granulated work is distinguished by its extreme delicacy; that of the Greeks by its elegance, lightness, and symmetry of form, with a certain freedom of style in the application of enamel and in modelling the small figures of gods; while manly beauty, recognisable in broader forms and greater solidity, are the chief characteristics of the Roman School.

The excavations and discoveries of Cumæ, Ostia, and Kertsch, in the Crimea, afforded fresh bases to work upon, and helped us to ascertain that works, hitherto regarded by antiquarians as of Greek origin, belonged in fact to the Etruscans: while others, attributed to the best times of imperial Rome, were recognised as originating from the earliest period of the Empire or from distint colonies. In imitating old Roman jewellery we found no difficulties, but that of the Etruscans and Greeks required much patient labour. Innumerable trials were made before the granulated work and the different enamels could be produced, and it is not long since we discovered (while examining an Etruscan ornament in our own collection through a magnifying glass) that the spots from which the granulated work had been broken off presented the same appearance as the gold surface previously covered by enamel. This discovery taught us a method of "granulating," which modern goldsmiths had till then declared inimitable. We were enabled to announce that we had solved the best part of a problem on which our attention had been bestowed for nearly twenty years. Gratifying as these results were, they did not satisfy us, because we had not yet gained that perfection which distinguishes antique ornaments. We were bent on further discoveries, and after the most laborious researches, we also mastered the Phœnician and Greek modes of granulating. We were no less anxious to arrive at a true issue in reference to the ancient modes of enamelling, and will briefly communicate the result of our experiments. Formerly, the general belief was that the art of enamelling on gold was unknown to the Egyptians, Etruscans, and Greeks. We have only few specimens of Egyptian workmanship bearing traces of enamel; and the beautiful objects found in Thebes in the sarcophagus of Queen Aah-Hoteh, by A. Mariette, show no definite signs of its employment. The decorations and many coloured bases of these ornaments, instead of being enamelled, are of dice of various stones, and as Mariette assures us, the source of these stones is to be found in the immediate neighbourhood of the tombs. All these pieces of hard and soft stone are cut separately to the different forms by the emery wheel, and were probably afterwards set in so many *cloisons* or cells of gold by other substances unknown to us, so as to form borders on the feathers of holy birds and other religious emblems, all of rough and truly Egyptian design. From these Egyptian productions originated, no doubt, the Lombardic, Gothic, and Anglo-Saxon dice decorations in precious stones, and perhaps also the cloisonné-enamel of the Byzantine artists. Among all the works in gold of Egyptian origin known to us are only two examples of the use of enamel: one in the Campana Collection, representing a bird with open wings and a human head; the other, and very similar one, is at the Louvre Museum. It is, however, uncertain whether even these ornaments are really of Egyptian workmanship or not; but if so, they no doubt belong to a period in which Greek art had already spread over the country of the Pharaohs. The use of enamel among Egyptians must therefore remain a doubtful question until some more convincing proofs are at hand.

Far different is it with the Greeks and Etruscans, and we could enumerate a long list of Greek and Italian enamelled ornaments contained in various cabinets of Europe. It must, however, be stated that the ancients were very sparing in the application of enamel, as if afraid of covering too much of the beautiful natural yellow of pure gold with the coloured glassy substance. Gold was then very rare, while these gay coverings were comparatively plentiful, being already used in the manufacture of vases, cups, amulets, and necklaces. The Greek and Etruscan objects left to us show plainly that the makers were perfect masters of the art of enamelling, and that its scanty use is due, as already mentioned, to a natural aversion of hiding too much of the gold's splendour. Besides, it may well be supposed that artists who could control the fire so well as to solder the minutest grains of gold, and spin gold threads of extreme fineness, and who obtained by chemical agents so many kinds of transparent and opaque enamel, were not ignorant of covering a gold surface with that substance. Numerous and convincing proofs remove all doubt on this head. We cannot help admiring the good taste which guided their employment of enamels, not only in the choice of colours, which are mostly light and delicate, but in the general application producing an harmonious whole. The enamel is generally laid in small cells of wire, forming handsome designs, and often used to cover the bodies of small mythological birds. In these cases the effects are splendid, the dazzling white and the delicate shades of green and blue are so beautiful as to cause the envy of modern enamellers, the Hindoes excepted, who are still far advanced in this branch of art.

Among the principal objects in granulated gold of Greek and Etruscan source, we may mention the magnificent crown in the Louvre Museum and the necklace of Milo in the British Museum—works which we have copied. Special mention may also be made of the dice in beautiful enamel work, the earrings with cocks, parrots, little dogs, &c., the two necklets with butterfly clasps, all found in Vulci, and forming part of our own collection of antique jewellery. With the Arabian element, which became scattered through the whole Roman world, the art of enamelling, so much favoured by the Eastern nations, also spread and gave rise to the famous schools of Venice, Limoges, and Florence. Their repective types are well-known. Jules Labarte, the learned archæologist, in whose writings the art of enamelling in the early and middle ages is fully treated, calls attention to the speciality hitherto unnoticed. This is a sort of transparent cloisonné-enamel, often mentioned in the inventories of Merovingian kings. Labarte says that this kind of enamel was used in those days in the manufacture of certain royal drinking cups only; and it was, no doubt, very suitable for this purpose, as the transparent and lively coloured decorations of geometrical patterns could be seen while drinking. He adds that up to the present time he has not been able to discover a work of this kind; but as a proof that it did exist and was highly valued, he refers to the writings of Benvenuto Cellini, where the Florentine jeweller states that Francis I. showed him a goblet of this sort, and asked his opinion as to its probable mode of production. Modern jewellers, encouraged by Labarte, bestowed their attention to this lost art, and we are glad to say that we have mastered it also. Several of our trial productions submitted to this celebrated archæologist met with his entire approval, and he recognised in them all the lost characteristics of the Merovingian enamels.

For some time we have also devoted our attention to mosaic-work. At the period when we began this branch of decorative art, most workmen in that line were unoccupied, and the few articles produced were unimportant—mostly copies of modern designs, without taste and artistic value. We were the first to apply mosaics to Classic jewellery, and our models were copied everywhere. Thus we went on instinctively, without knowing whether the ancients ever used mosaics for personal adornment or not. Some time afterwards we had, however, the pleasure of beholding an earring in the Neapolitan Museum, a relic of the best Greek period, and ornamented with small pieces of coloured mosaics applied in the very style we had adopted for our modern jewellery. The discoveries in the Basilica of St. Alexander and in the Roman Catacombs made us desirous of imitating some of those Christian works, which, though rude in design, were still remarkable for their simplicity. We decided on copying some of the best mosaic-work in the old Roman Basilicas on a small scale, and for our success herein we are greatly indebted to Count Oülsoufieff, well known for his vast knowledge of Greco-Oriental art. Unfortunately, he did not live long enough to enjoy the results which he was so instrumental in bringing about. We have also succeeded in producing some satisfactory niello-work.

Thus, after years of careful study and innumerable experiments, we were enabled to reproduce the best models of the worthy masters of our art. We devoted our attention to the Etruscan, Italo-Greek, pure Greek, and Roman schools in succession, and these were followed by imitations of Christian and Byzantine models. The success which attended our endeavours encouraged us to try the Italian Renaissance, and we have also been enabled to revive the works of the leading artists of that period; especially those of Benvenuto Cellini. Comparatively few relics are left to us from the Renaissance: the great value of the precious stones used in ornamenting them, doubtless occasioned their scarcity. Our models would therefore have been very limited were it not that the contemporary painters preserved the ornaments of the period with such fidelity as to allow correct imitations. Our labours ended with the Italian Renaissance, as the goldsmith's art has not since produced anything new deserving special attention.

FOREIGN WATCH TRADE COMPETITION.

A GREAT deal has recently been written concerning foreign competition in the watch trade, but a subject of such vital importance cannot be too well ventilated, and the opinions of those qualified to speak on the matter, especially if from a disinterested and well-meaning source, are worthy of consideration. Mr. C. S. Murray, M.B.H.F., deals with this *bête noire* in a letter to the editor of the *Coventry Herald* and *Free Press.* He says: "It seems to me, from what I have both heard and read, that the principal grievance is directed against the introduction of the American watch. Now, this outcry is neither consistent nor fair; that is, according to my notions of fairness. In proof of this let me state that we have had both French and Swiss watches pouring in upon us like an ever rising never receding tide for years and years—aye, and years; yet we have never raised the war cry of 'the country is in danger' against them. That there have been silent grumblings I am well aware; but certainly nothing like the denunciation of the *real* foreigners to that which has arisen against our cousins from the other side of the Atlantic. Now, how is this? Is it that we feel we are being harder hit from Elgin and Waltham in our own style of fighting—the straight from the shoulder—than was ever possible by either Besançon or Geneva? Our calling out about being hurt in the way that we are doing looks, in the eyes of the impartial observer, very much like it. Has it never occurred to us that there is room enough in the world for brother Johnathan as well as ourselves, and that if any were likely to go to the wall it would be France and Switzerland? My reason for thinking so is that the Americans have adopted our style of solidity and finish, leaving our own special connection to ourselves by dropping the fusee and relying upon the going-barrel. That being so, our wisest action will be to look the situation straight in the face, and to make up our minds that whichever of the three countries—the two foreign ones and our Yankee kinsman—have to be shouldered out of the field, brother Jonathan will *not be one of them.* That we may depend upon at any rate."

Further on he states: "The horological reputation of England stands so high, and is likely to always so stand, that we can very well afford to be both just and generous to a rival —the more especially when that rival is 'our near kinsman.' We must not allow even the faintest 'shadow of a shade' of unfairness to be shown by us in the discussion of a subject which, as much as most trade subjects, will challenge a large amount of patience and good temper. These are the reasons which have induced me, Sir, to beg admission to your columns for the purpose of rectifying what misstatements have been hitherto made."

When speaking of the quality of American works, he remarks: "I had always a strong prejudice against the going-barrel for producing anything in the shape of passable timekeeping, being a fusee man to the back-bone. I consented, however, to try an American instrument; it was a keyless 14 size—rather smaller than our 14—compensated and adjusted. I rated it for six months, and I can confidently affirm that the variation for mean time never exceeded 45 seconds a month. I have tried several others of these watches—non-compensated—but I have not found any of them at all of the inferior character which one of your correspondents has given to them. They are far superior to any Geneva that I have ever tested; they are much more solid, and, although they use the anchor pallets with club-teeth 'scape-wheel—which I wish they did not—they are quite able to hold their own, price for price, with anything that I have as yet seen. Contrary to the assertion of one of your correspondents, I have failed, after the closest inquiry, to discover any one who has abandoned a good American watch for either an English or a Geneva one. I admit that a plain, low-priced American instrument may have been given up for a superior English one. But that is a very different thing to what is sought to be established. If we have no case, it certainly does not become us to abuse the other side, for that will not get rid of facts as they stand. After the trials that I have made, I have been forced by the truth staring me in the face to throw to the winds the last shred of prejudice against a well-made American going-barrel for all the practical purposes of every-day life. I have examined the pivoting, the wheel-cutting, the jewelling, and the springing of these watches. I have them all before me now, and I must lie if I say that, cost for cost, they are not fully equal, if not in some respects superior, to what I have seen in both English and Genevese.

"We must bear in mind that the Americans have gone in for the million—the five pounds and under voters—which we have not paid sufficient attention to. It is only of late that I have heard that they are about producing going-barrel timekeepers for the purposes of navigation and astronomy!

"The main-springs of the American going barrel watches are of the best material that can be bought, and made in the best way. They are comparatively weak and thin to that of a fusee watch —the reason is obvious; the great wheel being on the barrel, the spring has not so much work to do as with a fusee. I measured the spring of the 14-size already spoken of, and it was nearly twenty-two inches long. I am not positive whether that gave eight or nine turns; however, I will venture on nine, although I am open to correction upon the point. Of these nine turns three and a half will do the watch's full day's work, leaving five and a half to the good upon the barrel arbour. If any experimentalist will, therefore, wind one of these springs up to the top, apply the adjusting rod, and note what weight the spring will carry, he will become interested in it. Let him next take down three and a half turns and apply the adjusting rod again; he will now be surprised at the small difference between the two weighings. He will see that it is merely a matter of good workmanship, to so spring a going barrel that the comparatively slight unevenness of the "pull" can be isochronised by a well poised, well made, and well sprung balance. It has been proved to be quite practicable to have so many coils in a main spring that the three or four upper ones will bear a marvellously close synchronism to one another, and that it is only *below* those turns that the unmanageable disturbance begins. Experimental horologists know the facts well, and in their existence lies the secret of the timekeeping properties of the American watch. I have seen it stated that these watches have no stops. That is not true so far as regards those that have come under my observation, for they all had stops. With respect to the cases. The Americans are having their cases made in England, solely to gratify the prejudice of John Bull in favour of his beloved 'Hall-mark,' and nothing more. There is no deception either intended, or possible, because the name of the American maker is on the upper plate of every watch just like that of any other maker."

Mr. Murray tells the Coventry watchmakers, if they want to inspect the American system of watchmaking, to visit the English Watch Company's establishment at Lozells, Birmingham. "There can be seen," he says, "a methodically organised graduated system, and the admirable instruments that that system produces. I have examined, too, first rate work in Coventry, as good as the world can show." To watchcase makers desirous of improvement, he advises them to take a lesson from their enterprising fellow townsman, Mr. Thomas Wallen.

Aluminum has a melting point intermediate between that of zinc and silver. It is a good conductor of electricity, being about eight times a better conductor than iron; is also a better conductor of heat than silver. It has an exceedingly low specific heat, and therefore does not take a long time to liquefy. It has been subjected to high temperatures in closed vessels without exhibiting any tendency to volatilise. It is not

THE HALL-MARKED WATCH CASES CONTROVERSY.

SINCE our last issue a deputation of watchcase makers and watch manufacterers waited upon Sir Charles Adderley, President of the Board of Trade, with a view of obtaining the support of the Government to the motion made by Sir Henry Jackson, M.P., in the House of Commons, for a committee of inquiry in reference to the hall-marking of gold and silver. The deputation stated that a large amount of fraud was being practised by foreign-manufactured watchcases being stamped at the Goldsmiths' Hall by any person presenting them, and therefore asked that the Government would lend its aid towards preventing foreign-made cases being stamped with the English hall mark except with some further mark to distinguish them as foreign made. After remarks from several members of the deputation, Sir Charles Adderley stated that an inquiry must deal with a much larger subject than they wished to raise; and he therefore suggested that they should get Mr. Eaton, M.P., to introduce a Bill, which would be the best course.

The following letter on the subject written by Mr. Louis Platnauer, of St. Paul's-square, Birmingham, appears in the *Birmingham Post* of the 12th ult. :—

My attention has been drawn to a paragraph in your valuable paper on the 6th inst., referring to a deputation of watchmakers who waited upon Sir Charles Adderley on Monday, to ask for a committee of inquiry into the hall-marking system, and calling his attention to a grievance they labour under—viz., that foreign-made cases for foreign-made watches are systematically sent to this country to be hall-marked, and are then returned and fitted with foreign works, the watches thus made being offered to all parts of the world as English watches.

During my experience of more than five-and-twenty years as a manufacturer and importer of Geneva watches, having my depôt in Birmingham, and doing business in England, Ireland, Scotland, and Wales, I have never heard of Geneva watches being sold to the trade as English, nor of their being foisted upon the public as such. For many years complaints were made respecting the inferior quality of the silver in Geneva watches. My house was the first to remedy this evil by initiating the system of having hall-marked cases for Geneva watches, and therefore upon me rests the responsibility of wronging the British trade and public, if wrong has been done.

My object was, and is, to give to my customers an article of undoubted quality. Of the fidelity of the movement the working watchmaker can judge; and as to the cases, the hall-mark gives a warranty of fineness understood by the most inexperienced.

An appeal may be made to the House of Commons upon this subject; and possibly through a want of technical knowledge such an appeal may be successful, and an act may be passed prohibiting the hall-marking of foreign silver. But what would be the result? The country would be flooded by Geneva watches purporting to be in silver cases, while in truth the cases would consist of less than a moiety of pure metal. The same remark applies also to gold. Thus a fraud would, indeed, be practised on a gigantic scale.

Now, surely the first duty of a Government should be to protect its people from fraud, and this, in the matter before us, would best be secured by the encouragement, not the prohibition, of the system I had the honour of starting. If you canvass the watch manufacturers in England, not only are they unable to give you an instance where a Geneva watch has been sold as English, but they know that such a practice is quite foreign to the trade. The present law which prohibits the name and address of watchmakers in England being put upon Geneva watches without the addition of the name of a Swiss town to denote their foreign manufacture should be enough, one would suppose, to silence the sophistical argument that they are sold as English manufactured goods.

NEW PATENT FOR SOLITAIRES, STUDS, &c.

THE accompanying illustrations show the features of a very ingenious and useful patent action suitable for solitaires, studs, &c., which has recently been introduced, and bids fair to supersede others now in use. The "Tourniquet," under which name this patent has appeared, seems to present entirely new and unique features. The stud being all in one piece offers considerable facility for rapidity of fastening, while it very greatly reduces the chances of loss.

From the accompanying illustration it will be seen that unusually small button-holes are required, and that the usual "crumpling" of the cuff may be entirely avoided.

The principle of the "action" consists of two parallel springs acting upon a square bar passing vertically through the centre, the springs being inclosed in an oval-shaped moveable tube, a quarter of an inch deep, there being a boat-shaped piece at the end of the square bar which forms the back of the solitaire. Fig. 1 shows its position when ready for use, when it is simply passed through the button-holes, and by a quarter turn, either to right or left, is at once effectually secured to inner side of cuff, as shown by Fig. 2; the tube by this action being retained in the button-hole, the springs in the tube making the solitaire perfectly secure. On unfastening, the same quarter of turn to be repeated, by which the back of solitaire will be returned to its former position, as shown in Fig. 3, and then ready for removal.

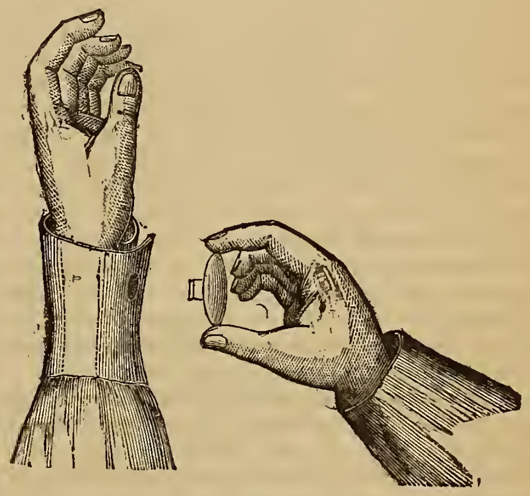
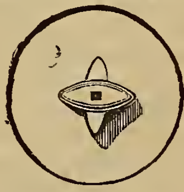
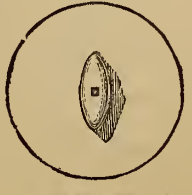


Fig. 1.



Inside the Cuff.

Fig. 2.



Outside the Cuff

Fig. 3.

Mr. A. A. Fridlander, of Hylton Street, Birmingham, has, we understand, acquired the sole right of manufacturing these articles in gold.

INFLUENCE OF AIR-PRESSURE ON CLOCKS.

(Extract from a paper read before the Society of National Sciences at Neuchâtel, by Dr. Hipp.)

[Translated from the *Journal Suisse d'Horlogerie.*]

IT has been demonstrated that the timekeeping of a clock is influenced by the degree of density of the air in which it moves; but the variation thus caused is so slight as to require a first-class regulator to discover it; and the most curious fact is, that while one clock retards under a stronger air-pressure, another advances under the same influence. The means adopted for compensating this barometrical influence are more or less successful in practice.

Several astronomers maintained the opinion that the degree of density did not directly affect the speed of the pendulum, but only the extent of its arc of oscillation, and it follows, therefore, that the variation in the clock is not due to an alteration in density of air, but to some secondary cause—viz., the change in the arc of oscillation. This would explain the fact that one clock advances while another retards; for we know—thanks to the ingenious experiments of Winner and Longier—that the suspension spring, according to its length and thickness, may be combined with the weight of the bob so as to produce isochronisme, and we add that the escapement will produce similar results. Admitting that the air-pressure affects the arc of oscillation, and that this influence explains the variation in the timekeeping of a clock, would it be safe to conclude that the density of air produces no other effects; or may we not rather suppose that this force alters the amplitude, and acts also in the speed directly; and thus explain the observed facts by combining both influences? We have tried to clear up this question by experiments.

We know that a pendulum or balance makes a larger oscillation in rarefied than in dense air, and, therefore, by observing the movements of a clock in rarefied and afterwards in compressed air, we should be able to value the effect produced. The execution of such an experiment presents, however, so many difficulties that we were obliged to abandon it and adopt an easier method. Experience has led us to believe that the resistances offered by air and water to bodies moving in these elements are governed by the same laws. Thus, by setting a clock in motion, first in water and then in air, we have two extreme cases; the density of water being about 773 times greater than that of air. This would then enable us to observe with the greatest facility what influence the respective media have on the movements of a pendulum. The difficulty of plunging the whole pendulum in water may be obviated by letting only some portion of it move in the liquid, just sufficient to produce the desired effect on the extent of the arc of oscillation. After this principle we arranged the pendulum of the regulator which controls the electric clocks of this town (Neuchâtel). This pendulum terminates with a steel point, destined to indicate on a scale the degree of the arcs described, and it is this point which should move in water. The receptacle containing the water was so disposed as to be easily raised or lowered, to cause the steel point to sink according to the requirements of the experiment. As the experiment was, however, to extend over some weeks, and the water would in consequence of evaporation diminish its height, we replaced it by glycerine, which underwent no alteration during the whole period of observation, and must confess that the results were quite different from what we anticipated.

For the benefit of those who are not acquainted with the organisation of the electric clocks at Neuchâtel, we must state that an electric signal, coming from the observatory at one o'clock daily, unhooks a coincidence clock, which enables to ascertain any error in the regulator to a sixtieth of a second. This error is daily corrected by means of auxiliary clocks, one of which causes the regulator to advance, the other to retard.* The total amplitude of the arc described by the pendulum in air was $2^\circ\ 54^m$, which was reduced to $2^\circ\ 6^m$ when the point was immersed in the glycerine for about 3/4mm. On plunging the point deeper into the glycerine the pendulum stopped. From the 11th to the 18th January, a period of eight days, the mean time of the regulator, with the pendulum point dragging in the glycerine, indicated a loss of $0^s, 4$ in 24 hours; and a second observation, from the 19th to the 26th, also eight days, made without the glycerine, and the amplitude restored to its original value ($2^\circ\ 54^m$), resulted in a retard of $0^s,24$. We were astonished to find that the timekeeping of a pendulum was so slightly influenced by its point moving in such an oily substance as glycerine.

What may be concluded from this experience? In our opinion it demonstrates that a difference of air-pressure, such as the variations of the barometer admit, and which are far from producing an effect on the amplitude of the pendulum comparable to the one we have just mentioned, has not a sufficiently important influence on the timekeeping of a clock to warrant a correction of this fault by barometrical means, an operation which has often been tried. If we admit, what is not yet definitely proved, that a more or less dense medium affects a pendulum by a change of its arc of oscillation only, any arrangement for this correction would be useless; because, by altering the length and thickness of the suspension spring far more serious defects may be rectified than those arising from barometrical height. We do not pretend that our experiment, and the deductions which may be drawn from it, suffice to settle this important question, but hope they will at least further its solution, and encourage other researches.

Some time after this paper was read, Dr. Hipp communicated the results of further experiments on the same subject, and to the same society. He says:

In my previous communication, I stated that the question relating to the influence of the density of a medium on the movements of a pendulum may be examined by letting the point of it move in water; but many have expressed their doubts on the comparison of the action of a pendulum in air and in water contained in a vessel. To give a satisfactory answer to this objection, I made some additional experiments; and although I admit that the means employed may still leave something to be desired as regards exactitude, I believe that the results which can be deduced from my research approach as near the truth as possible, always supposing that the difference in the densities of media is considerable. I made use of a half-seconds pendulum, steel verge, with a diameter of $4^{mm},5$, with a disc of 30^{mm} thickness, and 110^{mm} diameter; the weight of the pendulum was kils. 1,550. It would, of course, be out of question to entertain the movement of such a pendulum in water by means of any escapement, which would be sure to affect its action. It was imperative to measure the duration of a single, or a short series of oscillations to evade any sensible alteration in the amplitude. The spring suspension could not be employed either, on account of the influence which the spring would exercise in different amplitudes and media; and I was obliged to adopt the suspension *à couteau*, which does not interfere with the oscillations of the pendulum. A small contact mechanism interrupted and re-established a current at the end of one or several oscillations, and was so disposed as to leave the oscillations free for the whole duration. The pendulum oscillated in a water reservoir which could be filled or emptied at will, thus enabling the former to move in air and water alternately. The vibrations were measured by means of a chronoscope, which, as is well known, indicates the interval between the opening and closing of a current. I always made a series of measurements, which, between themselves, did not differ more than two to three thousandths of a second. It is true, this difference of a few thousandths of a second per oscillation would amount to three or four minutes in the course of twenty-four hours; but as the variation obtained, according to the medium, is about 100 thousandths, it will be seen that the result is exact by about 1/30. After many attempts to perfect my arrangements and method of observation, I found as the mean for seventy observations for a double oscillation *in the air*:

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* For particulars of construction and working of coincidence and auxiliary clocks, we refer our readers to our August number, Vol. III., as "Hipp's system" is also employed in the telegraphic transmission of astronomical time in Geneva, a full description of which will be found in the issue mentioned.

With an amplitude of 16° $1^s,01833$
" " 4° $1^s,01742$

Or for twenty-four hours:

With 16° amplitude a retard of $26^m\ 24_s$
" 4° " " $25^m\ 5^s$

The pendulum could, of course, have been more strictly regulated if it had been of any importance. We find, therefore, that the loss increases with the arcs, a result which I anticipated. The oscillations in water gave:

By 16° amplitude for the duration of an oscillation $1^s,08565$, or a daily retard of 2h. 3m. 20s., and by 4° $1^s,0859$ per oscillation, or a retard of 2h. 3m. 42s. The action of the pendulum in water, compared with its movement in air, shows, therefore, by 16° amplitude an additional daily loss of 1h. 36m. 56s., or 1h. 38m. 37s. for an arc of 4°. Let us consider the latter result of my experiment, which indicates a loss of 5917^s per day for the pendulum oscillating in water in comparison to its movement in air. From this we can deduce the variation resulting from a difference of 1^{mm} in the air-pressure; in fact, the mean pressure in Neuchâtel is about 720^{mm}, and if we take the figure 773 as the relative density of air and water, we have evidently

$$773 : 5917^s = \tfrac{1}{720} : X$$

that is, the pendulum varies daily by $0^s,0106$ per millimeter of barometrical pressure. This value of a hundredth of a second, as the effect of a barometrical variation of 1^{mm} on the movement of a pendulum, perfectly coincides with the results of experiments made elsewhere. We have, therefore, in my observations a proof of the reality of this barometrical variation in clocks which cannot be sufficiently explained by the modification a denser medium imposes upon the amplitude of oscillation; and I maintain that the fact of an advance in some clocks, followed by a loss in others under corresponding pressure, is due to secondary causes arising from the suspension spring, escapement, &c.

I am inclined to think that this barometrical variation can be compensated by some method similar to those applied for thermometrical compensation. It will, however, be necessary that the means adopted are delicate enough not to alter the movement of the pendulum by secondary influences beyond the few hundredths of a second which are to be corrected. The objection might be made that the results I obtained with a half-seconds pendulum are, perhaps, not applicable to a seconds pendulum, and, to satisfy myself on that point, I repeated my experiments with a pendulum of that description. The arrangements were the same, the bob also; only it was applied to a rod of about a meter, to cause the pendulum to beat the second as near as possible. About a third of its length was immersed in water; and although it would have been still more accurate if the whole of it had been plunged in, the difference is certainly without influence on the result. Without recapitulating the particulars of the mode of measurement, I give the indications of the chronoscope for the duration of ten oscillations:

In air with an amplitude of 8° the mean duration was $9^s,4799$
" " 4°, " " $9^s,4780$
" " 2°, " " $9^s,4762$

In water with an amplitude of 8° the mean duration was $10^s,0882$
" " 4°, " " $10^s,0792$
" " 2°, " " $10^s,0885$

To be as brief as possible, I limit myself again to the result obtained for an amplitude of 4°, and we see that the pendulum loses in water $0^s,06012$ per oscillation, or 5194^s=1h. 26m. 34s. per 24 hours; while for the half-seconds pendulum we had a loss of 1h. 38m. 37s. for the same period. An application of the previous computation demonstrates that an augmentation of 1^{mm} in atmospheric pressure is equivalent to a loss of $0^s,0093$ in the diurnal motions of a seconds pendulum. The loss in a half-seconds pendulum was $0^s,0106$, so that the retard is equal for both by about one-tenth of its value. At present I do not wish to discuss whether this difference is real, or only due to imperfect observations, and I beg to state again that I did not intend to obtain measures of the utmost precision. I believe, however, that I have experimentally shown that a pendulum oscillating free under the influence of its own weight only, without wheelwork or escapement, loses in a denser medium, and that this loss is about $0^s,01$ per 24 hours for an increase in the air density corresponding to a barometrical variation of 1^{mm}; and I repeat that the hypothesis of a similitude of the laws governing the movements of bodies in air and in water has received further confirmation.

JEWELLERY ROBBERY IN GENEVA.

A ROBBERY of jewels has been committed at Geneva, and, strange to say, has been detected. Both the crime and the discovery were attended with pleasing circumstances of good taste. It ought to be stated at once that the person robbed was not a lady of rank, who probably would have been no more fortunate than ladies of rank in England, but a jeweller and watchmaker. The deed was done early in the spring of 1877, in the following fashion. The shop of the jeweller is separated from the alley of which it forms part by nothing more solid than a wall of wood and plaster. The burglars therefore adopted the plan which has long been familiar to the profession in Eastern countries. They "broke in and stole," and the "crib" was literally "cracked." They had no need of the delicate centre-bit, nor the elegant "jemmy" on which the Western robber relies. A pickaxe and a spade did the business, while the police were absent on that excursion into unknown regions which they generally make when jewels or Gainsboroughs are being conveyed away. When the watchmaker presented himself at his shop next morning, his surprise was extreme and unaffected. Though the police had literally no clue, he declined to accept the good omen which an indifferent person would have drawn from the unusual circumstance. Weeks passed, and the affair was still dark as that one which Balzac chose to give a title to his novel. The public began to murmur at last that the sorrow and dismay of M. Troisétoiles—his highly respectable name is not published by the foreign papers—was but a feigned gloom. The student of Dickens will remember a person to whom his friends had given the playful title of Conkey, and who sought a doubtful profit in plundering himself. The gossip of Geneva would have it that the watchmaker was a Helvetian Conkey. They were entirely mistaken. Retributive justice was on the track of the rogues, in the shape of Madame C., a lady who ekes out an honest livelihood by letting out furnished lodgings to single gentlemen. Madame C. was confined to a bed of sickness at the time of the burglary, and she did not hear the details of the business till some weeks had passed. When she was informed about the local mystery she remembered a curious incident of an intimate and domestic sort, which had given some annoyance to the management of her household. She had let rooms to a young man named Larrieste, a native of Pau, who arrived with his passport in perfect order, and took apartments for two friends who were to join him. The friends arrived, single gentlemen of a Spanish cast of countenance. One morning, when the chambermaid went to clean the rooms occupied by Larrieste and his companions, she found that the basins prepared for the washing of hands were full of extremely black and dirty water. The beds, moreover, had not been slept in, and there were no indentions on the snowy pillows supplied by Madame C. When Madame C. heard of all this, for she was too ill to take an interest in the affair at the time, she compared the date of the departure of her lodgers, which was the day after they did not sleep in their rooms, with the date of the robbery of jewels. The two moments exactly coincided, and Madame C. communicated the result of her reflections to the police. M. Larrieste is a very ingenious young operator, but he made the fatal mistake reproved in a popular, not to say vulgar, lyric, "he was too jolly clever by half." On arriving at Lyons, whither he went after leaving Geneva and the house of Madame C., he wrote to that lady, saying that she might let his rooms, as he did not intend to return to Switzerland. This, of course, was proof that he had not carried away his booty, if booty he did indeed possess, but that he had hidden it somewhere near Geneva, and meant to come back for it. The police, therefore, kept an eye on the railway stations, and were fortunate enough to meet M. Larrieste and his friends on their arrival at Geneva. By what looks like an excess of zeal the detective arrested the men before they had dug up or otherwise uncovered and possessed themselves of their swag. They would have been able to pass as honest tourists, by whom the country of the Swiss is nourished, but for one small fact. Their portmanteaus had false bottoms. They were asked to explain this arrangement, which, it was pointed out to them, would be useful if they really came to carry off stolen watches and bracelets. They replied that they were neither robbers, nor exactly tourists, but honest smugglers. Their object, they said, was to carry the mild cigar of Switzerland, and the artistic lucifer match-box, free of duty, into the territory of the neighbouring Republic. Smuggling is a trade that is always brisk on the French frontiers, and we presume the bold smugglers are popular characters. When a nation has no klephts, no brigands, no dashing highway robbers, and few poachers, the smuggler is often a good deal looked up to by the people. He is understood to represent the protest of natural justice against the pale conventions of society. Perhaps political economists know why the people on the Franco-Italian borders, for example, prefer to buy cigarettes just across the imaginary line, and to slink back with them to Mentone. The cigarettes are made of inferior hay, and the match-boxes are distressingly crude in design, whether in Switzerland, France, or Italy. Possibly the popularity of smuggling may spring, as the American writers say, "from pure cussedness." But this is a digression. The bold smugglers were cast into a dungeon, to adopt the picturesque style of modern historians, and lay there for many months. At the end of June Justice was no better informed. The only thing certain was that Larrieste and his friends had not yet got their booty, and therefore that they would come back again. They were dismissed, and assured the head of the police that they would make Spain ring with complaints about their unjust imprisonment. M. Larrieste gave out that he was a friend of Castellar, for he had forgotten that he had originally described himself as a Carlist politician, To hear Larrieste, it would seem as if Spain would make the case a *casus belli*, and send an ultimatum to Switzerland. It is needless to show how greatly a war of this almost unprecedented kind would complicate the diplomacy of Europe. The chief of the police probably thought that the two States would find it difficult to get at each other, for in answer to the threats of Larrieste he merely bowed and said *au revoir*. It was not long before a telegram from Barcelona told him that his friends were moving towards the North. To disguise himself as a railway guard, to go to Lyons and take his place in the Rerrache station there, was to the trained detective the work of a few hours. It was he who gave the Spanish gentleman their tickets to Geneva; but they seemed to have suspected him, and slipped away in the crowd. They reached Geneva, dug up the jewels, filled their travelling bags, and went on foot to the little town of Nyon, in the Canton of Vaud. At Nyon they took the train to Lausanne, where they were arrested with the plunder in their possession. After a protracted trial they were found guilty, and sentenced to ten years' imprisonment, though one is to be taken off, in consideration of their former detention it seems, and of the trouble and worry which this unsuccessful affair has caused them. One question is still obscure. Where was the booty hidden? The police either do no know or will not say. Nothing is wanted but the solution of this problem to complete the joy of the people of Geneva and the relief of the owner of the goods. To non-professional people it seems that the thieves would have been well advised to employ confederates to recover the plunder. Perhaps in the general decline of commercial morality an unworthy suspicion has begun to exist even in burglarious circles. In no other way can one account for the thrice repeated, and on each repetition, more dangerous, enterprise. When there ceases to be honour among thieves, honest men come by their own. Many forlorn possessors of jewellery in England must hope for the general demoralisation of the housebreaking classes.—*Daily News.*

CURIOSITIES OF CLOCKS AND WATCHES

(*Continued from page* 176.)

THE third storey also consists of four divisions, which project in the manner of a balcony. Round the centre of the lower division move seven silver figures of heathen gods, in chariots, representing the seven days of the week; every deity makes its appearance once in seven days, exactly in front, where it remains for twenty four-hours, when it is relieved by the next. In the centre of the second division is an image of the Virgin, holding her son Jesus in her arms; two angels are seen placing crowns and garlands on her head, and during the performance of the bells several angels appear making their obeisance before the image of Mary and the Saviour. Within the centre of the third division is a metal bell hanging on a gilt plate of copper, in which is represented the Judgment Day. Round this metal plate move four silver figures, set in motion by mechanism, representing the four states of social life. These images point out the quarters of the hour by striking the bell; the first quarter is represented by a youth, the second by a grave citizen, the third by a Roman soldier, and the fourth by a priest. In the fourth division is likewise a metal bell, on the sides of which are chambers; on the left side is the representation of Death, proclaiming the hours of day and night by striking the bell; above it is seen a Latin inscription, from Romans, chap. vii., verse 23rd. At the right side is the image of the Saviour, stepping forward, with the globe in His hand, and above it the cross. This figure proceeds every two minutes, in a slow manner, and then, for a moment, hides itself from view. Above it is a Latin verse from the Prophet Hosea, chap. xiii. These two figures are of massive silver. Behind the bell is inscribed the name of the artist, and the date, 1589.

The whole is covered with copper, beautifully worked in filagree. On the extreme top is stationed a silver cock, which at the close of the chiming of the bells spreads its wings, opens its beak, and crows, after which it resumes its former position. On the side-doors are painted and gilt figures of the Virtues, with flowers, obelisks, and other ornaments, and within are figures of the Fates. These exquisite figures are stated to have been engraved by the pupils of the maker. The clock stands about four feet high, independent of the pedestal. It is said to have been made by Habrecht for Pope Sixtus V., and in many respects it resembles the famous Strasburg clock, of which it is evidently a model, since it performs all the feats of that clock.

The old church at Lubeck is considered to contain one of the most ingenious specimens of early clockwork that has been preserved. It represents the changes of the heavenly bodies until the year 1875; and when it strikes twelve a number of automaton figures are set in motion; the electors of Germany enter from a small side door, and perform the ceremony of inaugurating the Emperor, who is seated upon a throne in front. Another door is then opened and Christ appears, when, after receiving His benediction, the whole cavalcade retires amidst a flourish of trumpets by a choir of angels. On each side are bas-reliefs illustrative of passages in the life of our Saviour. In that of the Last Supper a mouse is seen peeping from beneath the white table-cloth, and this animal represents the armorial bearings of the once puissant Lubeck.

The Germans, who were from the earliest times famous for their horological skill, were chiefly employed in the manufacture of clocks in England during the sixteenth century; but their work does not appear to have been of much account, or Shakespeare would not have made Biron say that a woman was

> Like a German clock,
> Still a repairing, ever out of frame,
> And never going aright.

The English and the Augsburgers became famous for their clocks and watches, and made many of the latter, and also table-clocks which showed the hours, the phases of the moon, and the days of the month. At Augsburg were also constructed most of the clocks and watches with moving figures, such as a Moor, a monkey blowing a trumpet, and similar toys moved by clockwork concealed within them. These toys were chiefly made and used for presents from the ambassadors of Christian countries to Oriental princes and barbarians. At Nuremberg is stated to have been made a miniature silver army of cavalry and infantry, which moved their limbs, went through their exercises, and fired by clockwork within them. In the cities of Augsberg, Nuremberg, and Ulm clock and watchmakers were obliged to observe certain ordinances; and also, as a proof of their skill and ability for a masterpiece, to make a horizontal, square, or hexagonal table-clock; masters' sons were free to choose which, and eight months' time was given them to complete the work. The artists of Augsburg and Nuremberg used to bring their clocks and watches in great numbers to Leipzig fair, and thus they were spread abroad over Europe. Nicholas Rugendas was a celebrated clock-maker of Augsburg in the sixteenth century.

(*To be continued.*)

IMITATION CORAL JEWELLERY.

MESSRS. JOHN JEFFERYS & CO., of London, have introduced a novelty in brooches and ear-rings, manufactured from a material named Neapoline, and which is a very faithful imitation of coral. The articles are made in such tasteful and artistic styles as must secure a large and ready sale. The material is something entirely new, and is, we believe, solely manufactured by Messrs. Jeffreys & Co. It is also used for necklets, collarettes, bracelets, solitaires, &c., and from the styles before us is to be greatly admired.

BARRAUD AND LUND'S "RAILWAY WATCHES."—We hear that the Government of New South Wales has given an order for over thirty watches and a number of station clocks to the above well-known firm of chronometer makers, after a severe trial of one of their "Railway Watches."

BOOK NOTICES.

Treatise on Modern Horology, in Theory and Practice. Translated from the French of Claudius Saunier, by Messrs. JULIEN TRIPPLIN & EDWARD RIGG, M.A. Part I.

The first part of this valuable work is to hand, and, as might have been expected from such well qualified translators, does credit to the original. We have long been familiar with the French edition, and have often regretted that such a vast amount of theoretical knowledge and practical experience should be at the command of those only who are fortunate enough to master the French language. We can confidently assert that the work has not suffered any of that loss which generally attends the rendering of such a work from one language into another. We are glad to observe that the translators have strictly adhered to the judicious arrangement and clearness of style which are the characteristic features of the original; thus making it accessible not only to the skilled horologist, but also to the less experienced workman and apprentice. The large coloured copper-plates and numerous woodcuts are simply magnificent, and assist materially in rendering the subject easy of comprehension to every attentive student. Nor has any expense been spared in the outward form of the publication, the matter being printed on first class paper in bold, clear type. Part I. contains, besides a classification of the various escapements in use, a lucid explanation of the elements of mechanics. It is accompanied by a coloured copper-plate of the cylinder escapement. We have no doubt that the laudable endeavours in bringing such a standard work before English readers will meet with the approval and support they deserve. For terms of subscription, &c., we refer our readers to an advertisement in another part of our journal.

Diamonds and Precious Stones. By H. EMANUEL, F.R.G.S. Second Edition. (Chatto and Windus, Piccadilly, London.)

This book has been so highly appreciated, not only by the trade, but by the public in general, that the first edition was rapidly exhausted; thus necessitating a second, which we have now before us. The first class style which characterises all the publications of this well-known firm needs no further comment. We may briefly state that important corrections and additions have been made to their issue, and that the subject is treated in such an instructive and interesting manner as to render it acceptable to all readers alike. The author's object is to supply a book of reference in a compact form, serviceable to the inexperienced purchaser as well as the trader, by combining a long personal experience with the information offered by similar treatises in other languages, and we may well congratulate him on his success. Not the least important among the large amount of practical information contained in these pages, are a number of simple tests for ascertaining the genuineness of stones. Numerous plain and tinted illustrations are dispersed throughout the book, and it is altogether a most valuable and handsome volume, which should not be absent from any bookshelf.

Apparatus for Testing the Value of Lubricants. A Paper read before the Manchester Association of Employers, Foremen, and Draughtsmen, by Mr. W. H. BAILEY, of the Albion Works, Salford.

This interesting pamphlet contains much valuble information about lubricators, and describes various interesting methods and appliances for testing the same. We shall give our readers some extracts relating more particularly to watch and clock oils in our next issue.

The Montyon Prize of the Paris Academy of Sciences has been awarded to M. Caspari for his work on chronometers.

THE

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TRADE RECIPES, &c.

Brass Wire should be softened before being used for rivets. To soften, heat and allow to cool, or dip in water.

Solution for producing High Blilliancy in Silver Work.

Cream of tartar	30
Sea Salt	30
Suphate of alumine and potash	30
Water	1500

Boil the articles in this mixture.

Soldering Cast Steel.—The material employed is pulverised white marble. The two pieces to be soldered are simply heated, rolled in the marble dust, then quickly placed one in the other and hammered. This recipe is due to M. A. Fiala, an eminent mechanician, of Prague, and was communicated by Mons. G. Bertrand to the *Revue Chronométrique*

Microscopic Crystals may easily be obtained by placing on a warm watch-glass a drop of the concentrated solution contained in a second watch-glass, a thin film being thus obtained. The upper glass should not be pressed, but allowed to rest of itself. The drop thus expands into a film; and if a few drops of ether be placed in the upper watch-glass, the cold resulting from its evaporation will cause crystallisation to take place between the two glasses.—*Journal of Chemistry.*

A fine Gold Colour on Jewellery.—Boil 8 oz. saltpetre, 4 oz. alum, and 4 oz. common salt together in a porcelain or other fireproof vessel (not metallic) in barely sufficient water to dissolve them; add 9 ozs. strong muriatic acid to this solution, and filter. This quantity will be sufficient for colouring 4 oz. of work at a time, and should be kept in a well stoppered glass bottle when not in use. Another recipe for the same purpose is: Boil $10\frac{1}{2}$ ozs. saltpetre, and $5\frac{3}{4}$ ozs. common salt together, in a porcelain dish, in a quantity of soft water barely sufficient to dissolve them, and $\frac{1}{8}$ oz. nitrate of silver and $9\frac{1}{2}$ ozs. muriatic acid; filter. This quantity will also be sufficient for 4 oz. of work at a time, and should be kept as the previous preparation when not in use. To colour with either, anneal the work twice and boil it, each time after annealing, in a pickle consisting of 8 parts water and 1 part sulphuric acid. Then pour a sufficient quantity of the colouring mixture in a porcelain dish, and heat it to about 150° Fah. Hold the work in this for about two minutes, then take it out and rinse it in clean water. If not enough coloured to suit, the process must be repeated until the desired colour is obtained.

How to Restore to Nickel Movements their Original Appearance.—Take

50 parts of rectified spirits of wine,
1 part of sulphuric acid,
1 ,, nitric acid.

Immerse the pieces in this composition for about 10 to 15 seconds, plunge them in cold water, and afterwards in rectified spirits of wine. Wipe dry with fine linen or rotten wood powder. After this operation the nickelling looks like new; excepting any scratches which might have been made. This method is greatly in favour with the polishers of Geneva. Mons. Edouard Barbezat, of Neuchâtel, recommends the following process, which will not only renew the colour of nickel, but of almost any other metal that has undergone an alteration. Dissolve in half a glass of water 6 to 7 grammes of cyanide of potassium, dip the articles to be restored in this solution, but leave them only for a second. As the cyanide mixes freely with the water, it will suffice to rinse the pieces in cold water immediately after withdrawal, to prevent any of the cyanide from adhering. Plunge them into spirits of wine afterwards, and to obviate rust let them dry in saw-dust. Even balances with their spirals in order may be submitted to this operation without danger. If the objects are greasy they must be cleaned with benzine previously to being put in the bath, as cyanide will not attack grease. It must not be forgotten that cyanide of potassium is a violent poison, and the outside air should be allowed to enter freely into the place of operation. If kept in closed vessels this bath will serve for a considerable time.

Iron made Inoxidisable by Nickel.—A French *savant* recently communicated the result of an analysis of iron, no doubt meteoric, and brought from Saint Catherine, Brazils. This mineral is very rich in nickel, containing 64 parts of iron, 36 parts of nickel, and some traces of coal, phosphor, and silicium, and has the valuable property not to rust. Although immersed in water for several months, it remained intact. Bezelius stated formerly that meteoric iron did not oxidise, and attributed this property to the presence of nickel. A number of experiments, based on those statements, were also made by Mons. Boussingault with a view to finding an inoxidisable alloy of iron and nickel. Contrary to his expectations he discovered, however, that the nickol-alloys rusted much quicker than ordinary iron, and Faraday, who had made similar trials, arrived at the same conclusion. These contradictory results are difficult to reconcile with the observations made on meteoric iron containing a large amount of nickel. It is evidently a question of dose, and, in fact, as soon as the above mentioned experimentalist obtained an alloy containing 35 per cent. of nickel, all traces of oxidation disappeared. Nickel, proof against humidity, helps also to preserve the iron, and if the iron of meteorolites is not oxidisable it is to be attributed to its richness in nickel. Unfortunately this important advantage cannot be applied to industry, because iron alloyed with 35 per cent. of nickel can hardly be called by that name. The fact is, however, interesting from a scientific point of view. Mons. de Parville, who also comments on the above in a French contemporary, warns the reader against an iron-preserving process lately published as a capital discovery. This method consists in heating the iron to a high temperature, and the magnetic iron oxide thus developed protects the metal against rust. This is quite correct, but not new; everybody knows that steel springs are retempered at a considerable heat, that they become of a dark blue tint in consequence of this process, and do not rust. The object is, however, to obtain a preventive against oxidation which will also retain the characteristic metallic colour of the iron, a problem which, we are sorry to say, has baffled the skill of inventors to the present day.

PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

705. Martin Kosminski, of Aldermanbury, in the city of London, furrier, for an invention of "An improved Apparatus for use in effecting the winding-up of watches, clocks, and other mechanism, requiring similar winding up."—Dated 20th Febuary, 1878.

380. Abraham Van Winkle, of Queen-street, in the city of London, for the invention of "An improved method of plating metal, chiefly designed for the application of a coating or covering of gold, silver, or platina upon the surfaces of baser metal."

Notices to Proceed.

90. Charles Riballier, of Paris, in the republic of France, jeweller, has given notice in respect of the invention of "An improved process of decolouring 'coloured diamonds.'"

4123. John Clayton Mewburn, of 169, Fleet-street, in the city of London, Patent Agent and Consulting Engineer, has given notice in respect of the invention of "Improvements in watches."—A communication to him from abroad by Charles Delegrave and Ludovic Goillandeau, both of Paris, France.

4124. John Clayton Mewburn, of 169, Fleet-street, in the city of London, Patent Agent and Consulting Engineer, has given notice in respect of the invention of "Improvements in clocks."—A communication to him from abroad by Charles Delegrave and Louis Maximilien Grignon, both of Paris, France.

Patents Sealed.

4799. James Brockie, of Canonbury, in the county of Middlesex, for an invention of "New or improved apparatus for synchronising clocks."—Dated 17th December, 1877.

Patents Granted in Foreign States.

United States of America.

198,149. George Pitts, of Providence, R.I., assignor of two-thirds of his right to John L. Mason and George L. Mason, of the same place, for "Studs and buttons."—Application filed 13th October, 1877.

197,969. Frederick L. Ellis and Burdette A. Lewis, of Plainville, Conn., for "Manufacture of clock-keys."—Application filed 20th August, 1877.

5409. Florence Kroeber, of Hoboken, N.J., for "Clocks."—Application filed 26th November, 1877.

5417. Florence Kroeber, of Hoboken, N.J., for "Clocks."—Application filed 26th November, 1877.

5419. Florence Kroeber, of Hoboken, N.J., for "Clocks."—Application filed 26th November, 1877.

196,995. J. P. Simmons, of Fulton, N.Y., assignor to H. A. Simmons, of the same place, for "Packing the joints of barometers."—Application filed 27th April, 1877.

197,246. William A. Cates, of Union, Oreg., assignor of one-half of his right to R. S. Cates, of the same place, for "Geographical clocks."—Application filed 24th August, 1877.

197,068. Richard Whittaker, of Toronto, Ontario, Canada, for "Watches."—Application filed 20th November, 1874.

France.

119,643. Mansberger, for "Mounting the rings of watches."—Dated 27th July, 1877.

119,688. Mannoury, for "Improvements in paper cases for packing jewellery," &c.—Dated 31st, July, 1877.

118,798. Lacroix, for "Obtaining impressions on caoutchouc lace for bracelets."—Dated 1st June, 1877.

118,892. Blanvillain and Normand, for "Improvements in jewellery."—Dated 6th June, 1877.

118,921. Japy, Brothers, & Co., for "A travelling-clock."—Dated 8th June, 1877.

118,912. Carcanagues, of Paris, for "A clasp for ear-rings."—Dated 7th June, 1877.

119,015. Grignon, of Paris, for "A universal geographical clock."—Dated 14th June, 1877.

119,161. Guellier, for "A metallic cage for clocks, alarms," &c.—Dated 25th June, 1877.

119,177. Fouquet, for "Improvements in jewellery by mounting and converting a necklace or bracelet into a diadem."—Dated 26th June, 1877.

119,294. Speltz, for "Fastenings of ear-rings."—Dated 2nd July, 1877.

119,317. Bozerian, for "A barometer."—Dated 20th July, 1877.

113,751. Meunier, for "A watch."—Dated 14th July, 1877.

Australia.

2390. Robert Ellis Joseph, of Melbourne, Victoria, for "An invention for an improvement for adjusting clocks or other horological instruments to standard time."—Dated 9th July, 1877.

"Two short levers, forming a gripping arrangement, are placed above the figure marking room on the dial. These are made to close at pleasure and by any convenient means, at the end of any given hour, pushing the hands forward or backward as the clock happens to be slow or fast."

German Empire.

5633. K. Fritsch and J. Forster, of Vienna, for "A telescope.'—Dated 26th January, 1878.

5798. M. Winterhalder and Hofmeier, of Schwärzenbach, for "An alarm for eight-day clocks."—Dated 26th January, 1878.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Crisp, Alfred, Vyse-street, and Lodge-road, both Birmingham, jeweller. Jan. 25. A. B. East, sol., Cherry-street, Birmingham.

Mowbray, John Wm., Lynn-street, West Hartlepool, jeweller. Jan. 29. C. B. Hodgson & Haig, sols., 13, Waterloo-street, Birmingham.

Smith, Meyer, 47, Newport-road, Middlesborough, jeweller. Jan. 28.

Waterfall, Edwin, Everton, watchmaker and jeweller. Feb. 2. Crosier & Lumb, sols., 7, Moorfields, Liverpool.

Hampton, Daniel, & Robert Hampton, trading as Hampton Bros., Darlington, jewellers, &c. Feb. 5. T. M. Barron, sol., Darlington.

Hampton, Daniel, Darlington, jeweller, &c. (sep. cdtrs.) Feb. 5. T. M. Barron, sol., Darlington.

Hampton, Robert, Darlington, jeweller, &c. (sep. cdtrs.) Feb. 5. T. M. Barron, sol., Darlington.

Merten, Otto Frederick, 130, Caledonian-road, dealer in precious stones. Feb. 7. R. Wood, sol., 45, Fish-street-hill.

Danby, George, 116, Clarendon-road, Notting Hill, jeweller. Feb. 11. Kisch, Son, & Hanbury, sols., 3, Chancery-lane.

Friedlander, Salomo, Middlesborough, jewellery dealer. Feb. 13. Bainbridge & Barnley, sols., Middlesborough.

Hartshorn, Wm., 34, King's-square, Clerkenwell, watch manufacturer. Feb. 11. Kisch, Son, & Hanbury, sols., 3, Chancery-lane.

Jacobs, Morris, Corporation-road, Middlesborough, jeweller. Feb. 13. A. H. Sill, sol., Middlesborough.

Przedecky, Asher Michelson, trading as Asher Michelson, Middlesborough, jeweller. Feb. 12. J. R. Stubb, sol., Middlesborough.

White, Wm. Spencer, Victoria-street, Great Grimbsy, jeweller. Feb. 13. Wright & Marshall, sols., New-street, Birmingham.

Clamp, Geo., Regent-street, Weston-Super-Mare, jeweller. Feb. 21. At J. & S. B. Parsons's, accountants, Bristol, March 15 at 12. Baker, Phillott & James, sols., Weston-Super-Mare.

Crowther Joseph, King-street, Manchester, jeweller. Feb. 19. At Rickards, Walker, & Maude's, sols., 29, Lincoln's Inn-fields, London, March 8 at 11. Burman & Crompton, sols., 31, Cherry-street, Birmingham.

Dividends.

Inwood, Wm. (Liq.), Liverpool, jeweller. 2nd and final div. of 3d.; C. Conner, 57, Ranelagh-street, Liverpool.

Sequestrations in Scotland.

Ginn, James, 166, London-road, Glasgow, watchmaker. Feb. 2, with protn. Clms. by June 2. Agents, Wright & Johnston, Edinburgh, sols.

Applications for Discharge in Scotland.

Sutherland & Thompson, Glasgow, wholesale jewellers.

Trustees Appointed.

Hughes, Robert P. (Liq.), Chapel-street, Carnarvon, jeweller. Tr., T. Silverton, 23, Summer Hill-terrace, and Wm. J. Holmes, 148, Hockley-hill, both Birmingham, jewellers.

Pumfrey, John H. (Bkt.), Northampton-street, Birmingham, jeweller. Tr., R. L., Impey, Waterloo-street, Birmingham, accountant.

Aprile, Joseph, and Napoleon Aprile (Liq.), Sudbury, siversmiths, &c. Tr., C. A. Reeve, West Croydon, accountant.

Chambers, Geo., trdg. as Wm. Chambers & Sons (Bkt.), Powell-street East, St. Luke's, watchmakers. Tr., J. J. Saffery, 14, Old Jewry-chambers, accountant.

Norris, Jabez H., and Walter A. Norris (Liq.), Market-street, Manchester, manufacturing jewellers. Tr., H. Davis, Vyse-street, Birmingham, jeweller.

Treleaven, Wltr., (Liq.), Cornwall-street, Plymouth, watchmaker. Tr., W. Harris, Plymouth, accountant.

Ginn, Jas., 166, London-road, Glasgow, watchmaker. Tr., R. B. M'Gaig, 179, West George-street, Glasgow. Com., T. Muter, 145, Trongate, J. Hutchinson, 83, Union-street, & R. L. Hector, 33, Jamaica-street, all Glasgow.

Meetings.

Watt, John D., Elgin, watchmaker. J. Cruickshank's, Elgin, sol, March 7 at 1.

Chambers, Geo., trdng. as **Wm. Chambers & Sons** (Bkt.), Powell-street, East, St. Luke, watchmaker. At Bankruptcy Court, Lincoln's-Inn-fields, March 8 at 11, axam.

Discharges Granted.

Brown, James (Bkt.), Spennymoor, Durham, jeweller, Disch. granted.

Dissolutions of Partnerships.

Carson and Paton, Shudchill, Manchester, watch manufacturers, Jan. 30. Debts by Jas. Carson.

Kagenbusch, Kerr, Sekler and Co., Sally Port-ct., Newcastle, metal refiners. Feb. 2. Debts by Andrew Sekler.

Myers, John and Co., 131, Westminster Bridge Road, watchmakers. Jan. 22.

Distributions of Assets.

Ballard, Wm., Cranbook, Kent, watchmaker, died Dec. 12. Clms. by April 1 to Philpott and Wood, Cranbrook, sols.

Trust Deeds granted in Scotland.

Blumenstein, Frederick, Eglintont-sreet, Glasgow, watchmaker and jeweller. Clms. with Robert Reid, 40, St. Vincent-street, Glasgow, accountant, forthwith.

Marshall, Wm., Crieff, watchmaker, Clms. with Rbt. Clement, Crieff, writer, by Mar. 13.

ANSWERS TO CORRESPONDENTS.

R. J., Dundee.—We have replied per post, but our letter did not reach its destination. We cannot do better than call your attention to "Saunier's Treatise on Horology," which is now published in monthly parts at 1s. 6d. each, thus enabling any working watchmaker to possess himself of a standard work on the various branches of horology. The work may be ordered through the office of this journal.

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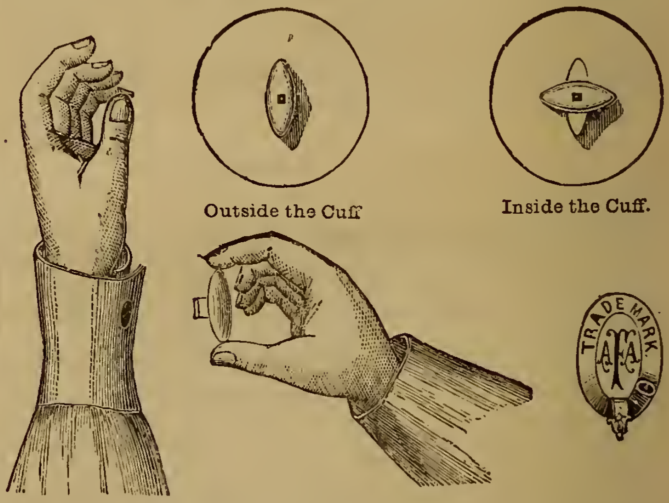
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MACHINERY IN ITS RELATIONS TO ARTISTIC PRODUCTIONS.*

MR. POYNTER, the president of the Art section of the Social Science Congress held at Liverpool, in his address to the Congress objected to the "Castellani" collection of Italian jewellery being sent to Birmingham on loan, because cheap and inferior copies would there be made mechanically; and in this objection Mr. Poynter embodied and expressed a very common idea—that mechanical work cannot be artistic work.

How far this is true I shall endeavour briefly to show, and I may at once state that I shall claim for all mechanical appliances the right and privilege of assisting in our art manufactures. I am prepared at once to admit that the enormous industrial progress of this country during the present century has really done very little for art. Our manufacturers have almost to the present time given their whole attention to economy and rapidity of production, and the public taste has not been elevated by the style of the articles produced. But allowing that in the past, and even at the present time, the taste and skill of the artist have been lost—sacrificed to the ingenuity and contrivances of the mechanism—we surely need not conclude that art cannot become an ordinary adjunct to mechanical reproduction. We know well that in many manufactures carried on by us to-day our best models in design, as well as in material, are those bequeathed to us by workers who lived centuries ago, whose mechanical appliances were of the simplest and rudest character; and it is with some sense of humiliation that we are bound to confess ourselves unable to equal not merely the works of three or four centuries ago of European civilisation, but even of those of the present day, introduced by nations which we are conceited enough to call savage. Let us take a few examples of the arts and manufactures of old time and compare them with those of the present day. Have we improved in the art of printing since its invention four hundred years ago, or in the art of paper-making of six hundred years ago? In quality certainly not. We are bound to remember that to-day an ordinary edition of a newspaper is printed on both sides in quantity sufficient to cover an acre in the same or less time than Caxton or Guttenberg required for the production of a single sheet. We produce paper now in continuous rolls of many hundreds of yards in length, and with a rapidity commensurate with the voracious requirements of the steam printing press; but no paper now in general use (excepting bank-note paper) equals in quality that upon which our early books are printed. Most of the books printed of late are, I think, likely to be entirely lost within a century, simply from the natural decay of the (so-called) paper upon which they are printed. But we can to-day buy a newspaper for a penny or a book for a shilling which in Caxton's time would have cost fifty or a hundred times as much. We can and do engrave dies and coin money for all the world, but we cannot produce anything comparable with the exquisite coins of ancient Greece. We can imitate in a feeble way the cameos and intaglios of the stone engravers of ancient Rome, but this is an art almost unpractised among us, and so far as we are concerned artistically, it is practically lost.

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* Abstract of a lecture before the Sheffield School of Art. By Mr. William Bragge, F.S.A.

In ornamental enamel we must go to China and Japan for our models, as Messrs. Elkington have wisely done, and then find out by painful experience how best to copy the humbler objects before daring to imitate the more important. Our English enamelling of to-day is confined pretty closely to the decoration of mayors' chains, masonic emblems, and the lining of iron pots and pans. The art of lace making or ornamental needlework—in Mediæval times one of the most general occupations of women of every rank above the lowest—is now entirely lost, and we must go to our museums to see the charming examples of taste in design and perfection in work which still remain for us to admire. The hand-made lace will bear microscopic examination: it consumed much time and patience in its production, and was consequently very costly. Nowadays one can buy in Nottingham embroidered curtains enough to furnish a house for less money than a collar of ancient point lace would cost. I might indefinitely prolong this list, and point out to you the comparatively lost arts of damasquining, or inlaying iron or steel with the precious metals; of the special forging of sword-blades in Damascus and Toledo to produce the twist in the fibre, so to speak, of the metal; of the remarkable skill in perforating steel and brass as a decoration of useful objects practised in Persia; of the marvels of design, colour, and glaze of early Italian pottery or majolica; of the exquisite glass and mosaics of Venice; the gold and silver smith's work of Italy; the shawls of Cashmere and textile fabrics generally of India; but further instances are not needed, and you will, I think, agree with that which is a commonly accepted opinion, that in all these, and in many other artistic manufactures, we, the English, are now utterly unable to compete. I have not made in the foregoing remarks any reference to painting and sculpture, because those arts stand outside of the reach of mechanical appliances, and therefore the painter and sculptor of to-day are in this respect in the same position as were Apelles and Phidias, Titian and Michael Angelo. And now we may proceed to consider what is the real or supposed antagonism between art as developed in individual workmanship and as accomplished or assisted by mechanical appliances. If we fairly compare the art of, say, the goldsmith or silversmith of three centuries ago with the art of to-day, we find that the workman then lived and worked under influences and incitements which have long ceased to exist. The Mediæval workman thought and cared only for the single object upon which he was employed. He threw his whole soul, his whole inventive faculty, his whole technical skill, into his darling work, and he knew that no meaner hand could rob him of the fruits of his patient labour and skill. He was not hurried with his work. He had no anxieties as to cost. His master, if he had one, was not perpetually crying out for the economies of labour and of material, no estimates had been given which could not be exceeded, and no arbitrary percentage of profit had been beforehand fixed. Is it extraordinary that under such favourable conditions the workman should produce his best? Certainly not, and we ought to be profoundly thankful that the results of such a state of things have been preserved to us for our special instruction. How does the working gold or silver smith of to-day stand in relation to his work as compared with his predecessor of three centuries ago? Truly in a miserable plight! Instead of being himself the creator of the design he has to carry out, it has probably been prepared for him in an office where the commercial economy of manufacture is more considered than the principles of art, where facilities of production are held to be more important than elegance of form, and where the demands of the Demon of Fashion override the desires of good taste. All the patient labour of hammer and chisel, slowly and surely giving expression to the taste of the individual, are dispensed with now, and are replaced with a few blows of the stamping machine! This stamping machine or press has taken the place of hand-labour, and, being only a machine, is perfectly indifferent whether the work it is called upon to do is in good or bad taste. It is as willing to work for the Demon of Ugliness as for the Spirit of Beauty, and the work which it produces is simply a reflex of the mind, and taste and quality of its employer. It is unfair to charge the mechanical appliances of manufacture with having caused a degradation of taste. The degraded taste existed when machines were first employed, and, unfortunately, the process of refining and improving the artistic feeling of the public has been hindered by the cheap and ugly mechanical productions. If the modeller will only produce moulds worthy of admiration, the stamping press is at his command to bring under the daily notice of everyone the forms of beauty which he has himself designed. We cannot, if we would, go back to Mediæval habits of thought or modes of work, and those who to-day would abolish all mechanism in art manufacture would injure instead of help their cause. The patience and skill of the modeller or chaser who wishes to devote months or years to the production of a masterpiece can still be given. He remains free to use his time and talents as he thinks best, and happily there is yet a demand for works of a high class in the production of which such men may be congenially employed. In this wealthy and art-loving country there is abundant occupation for the most skilful artists. Nothing that is really good fails to find a ready purchaser, and talent has to-day before it as fair a field as it ever had in days gone by. The gifts of corporate or public bodies to men who deserve honour; the production of prizes for excellence in exhibitions, for racing, or boating, or yachting; the demand of the wealthy for specialities designed for themselves, ensure for the conscientious workman full scope for his talents. And I am sorry to be compelled to think that this special work is more than enough to occupy all the competent workmen who can be found. In the production of such works machinery and mechanical reproduction have no part; they stand as individual works, each wrought out by a master mind, to fulfil a single purpose and to satisfy a personal want. But can the requirements of the million be dealt with in this aristocratic manner? Certainly not. For their wants every element of economy must be utilised; the means of production must be assisted by all the resources of mechanical science. The absolute perfection of detail must of necessity be given up, but there is no reason whatever why a high standard of excellence should not be preserved. Our jewellery, our gas-fittings, our table services, whether of silver, silver-plate, or other metals; our trays, coal-scuttles, fenders, and grates, and everything else which forms a part of our domestic surrounding, may as cheaply be made elegant as ugly. The use of machinery has only to be wisely and thoughtfully adapted, governed by artistic principles, and its results will be to give to the world in its cheapest form the useful and the beautiful.

FRENCH TURBAN BRACELET.

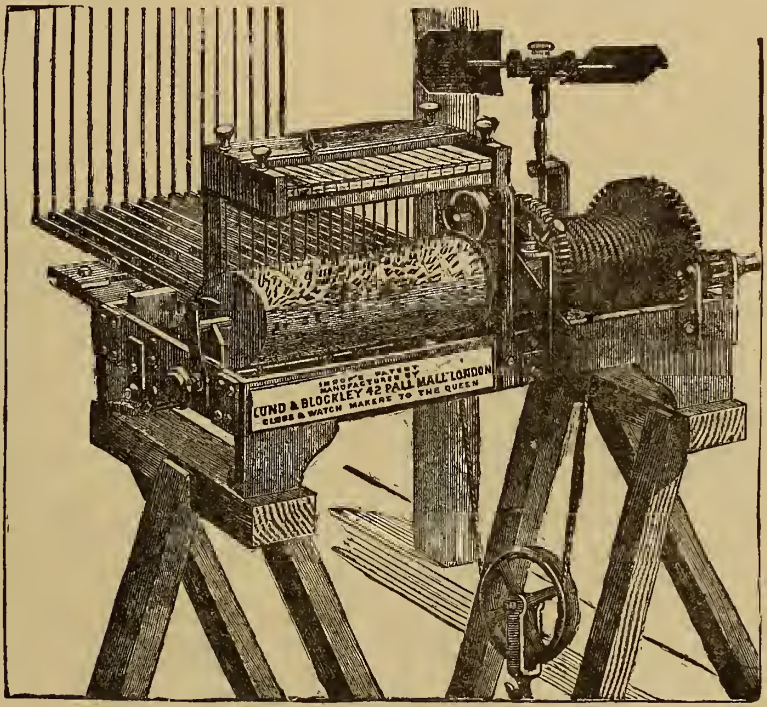
A NEW not loseable turban bracelet has been patented by Messrs. T. L. Lyon & Co., of London. It is manufactured in French Gold (18 carat, Government marked), and consists of a number of rows, from one to fifteen, which acting as a spring encircle the wrist and effectually secure the bracelet. The invention has met with great success in France, and will doubtless be equally successful here.

NEW CLOCK AND CHIMES AT WEST HACKNEY.

MESSRS. LUND AND BLOCKLEY, Clock and Watch Manufacturers to the Queen, of 42, Pall Mall, and William and Mary Yard, Little Pulteney Street, London, have just completed a clock and carillon machine at St. Mark's Church, West Hackney, the Rev. J. G. Pilkington, Vicar, some features of which are peculiar and of interest to our readers. The clock shows time on two 5ft. 6in. dials, has Denison's double three-legged gravity escapement, and a 1½ seconds compensation pendulum of the ordinary kind of zinc and iron tubes combined, and heavy cast-iron bob. The whole of the escapement is made of steel, the wheels and bearings are all of gun-metal, and the pinions of steel, hardened and tempered. The pendulum is suspended by a stone corbel in the tower-wall, and the clock-frame is bolted to stout oak brackets. It is provided with a four-arm snail on the minute arbour, with which it releases the locking arm of the striking and chiming part at each quarter. The striking and chiming works are fixed on a stand in the centre of the clock chamber, and consequently cannot convey to the going part any of the vibration caused by the falling hammer levers.

It is well known that under the usual plan of clock-making, three weights and three trains of wheels are used for the separate actions of chiming the quarters, striking the hours, and playing of the tunes, on account of the slowness with which the hammers are lifted before striking, as well as the time required to relift them for another blow on the same bell, and of the consequent great fall required for the weights. In Imhof's patent, however, under which Messrs. Lund and Blockley manufacture their carillon machinery, as shewn in the accompanying drawing, the hammers are lifted with such rapidity that with a revolving barrel of 12in. diameter a blow can be effected, the hammer relifted, and a second blow struck on the same bell in ⅜ of an inch of its circumference, while two inches at least would be required according to the old system. The great saving of fall of weight is obvious. As the chiming, striking, and playing cannot be done at one and the same time, it is preferable that one weight, heavy enough to raise the rapidly falling hammers in playing the tunes, and therefore also heavy enough for the slower falling quarters and hour striking, should perform the three operations in their proper sequence.

The principle of this patent is that the hammers are always held up by means of triggers, ready to descend and strike the bell. The discharge of the triggers is very light, and is done by small brass pins driven into a barrel made of wood, while the heavy work of relifting the hammers to the holding triggers is effected by a rapidly revolving cam of brass tube and steel rods, like a lantern pinion. If, therefore, all the pins necessary for the quarters, hours, and tunes for twelve hours are driven into the discharging barrel, revolving by the weight and train of wheels which drive the lifting cam, at stated intervals of quarters of hours, determined by the clock, and be further provided within itself with a stopping action to bring it to rest as soon as it has done its proper work, we have all that is required for the striking and chiming of such a clock. The same system is of course applicable to clocks which chime the quarters and strike the hours only. The saving of cost is evident, and it has the further advantage that a quarter clock can at any time, and without difficulty, be supplemented by the playing works. It will be readily understood that it is the position of the discharging pins in the wood barrel which determines the sound produced upon the bells; if, therefore, a barrel be marked and pinned with changes and rounds on any number of bells—say 12, 10, 8, or 3—they can be chimed on the bells for the services of a church. In the case under notice the Vicar was most anxious to avoid the too frequent annoyance of having men come to ring or not as they pleased. Two extra barrels have therefore been provided, one of which has on it a touch of Grandsire triples (392 changes on 8 bells), and another with rounds and two or three musical changes on 8 bells, rounds on 3 bells, and tolling on the tenor. At the half-hour before each service the first barrel is chimed through at the proper ringer's speed of 28 to the minute (the changing of the barrel in the machine can be done in a few moments, and without disturbing any other part), and for the last 10 minutes before the service commences the second barrel is used, the tolling on the tenor being for tolling in. All the hammers are extra heavy, so as to bring out the full tone of the bells.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MANUFACTURED BY
LUND & BLOCKLEY 42 PALL MALL LONDON
CLOCK & WATCH MAKERS TO THE QUEEN

The material and workmanship are of the best, and reflect great credit on the manufacturers.

The Cambridge quarters are struck on the 2nd, 3rd, 4th, and 7th bells, and the hours on the tenor. The tunes are "Rousseau's Dream," "Quam Dilecta," "Innocents," "Nicœa," "O Rest in the Lord," "The Churches one Foundation," "Home Sweet Home," "Blue Bells of Scotland," "Ring out, Wild Bells," "Those Evening Bells." More tunes can at any time be added, and it is proposed that at some future time a pianoforte key-board be applied for playing by hand.

Messrs. Lund and Blockley have executed many similar works, the most important of which are:—

At St. Mark's, Victoria Park, by gracious command of the Queen, carillon machinery for quarters, hours, and tunes and chiming for all the services of the church, with 11 bells.

At High Beech Church, Essex, similar machinery, with key-board attached for playing tunes by hand, with 13 bells.

At Colonel Tomline's, Orwell Park, Ipswich, machinery for quarters and tunes, with 16 bells.

At Longhirst Church, Northumberland, machinery for chiming for the services of the church, with 6 bells.

At Mitford Church, Northumberland, machinery for playing tunes, and chiming for the services of the church, with key-board for playing by hand, with 13 bells.

At Coleorton Church, Ashby-de-la-Zouche, large clock and machinery for chiming the quarters and striking the hours, to which tunes are hereafter to be added to 8 bells.

At St. Luke's, Derby, a large clock and machinery for chiming the quarters, striking the hours, playing tunes, and chiming changes, to a very large peal of 8 bells, and which was fully described in our issue of March, 1876.

Provision has been made in the tower for three clock faces, but as two were deemed sufficient for showing time in any direction, Messrs. Lund and Blockly proposed the third should be appropriated for a public barometer.

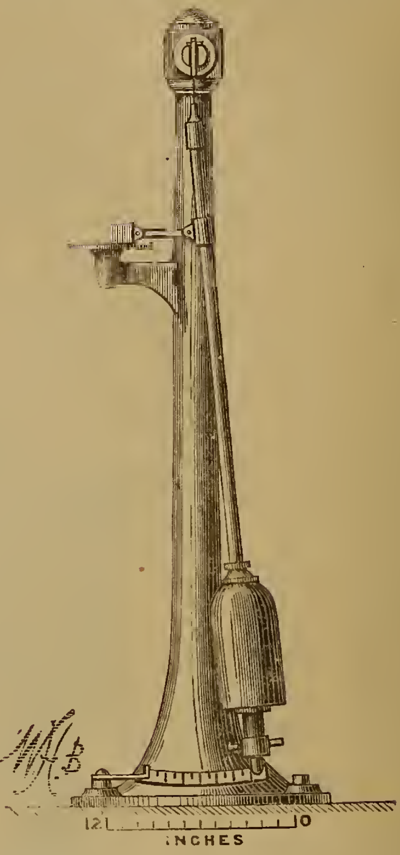
Doubt was expressed whether machinery could be made to show the rise and fall of a column of mercury by means of a hand on a dial 5 ft. 6 in. diameter, but the above-mentioned firm have secured, in conjunction with the inventor, a patent in England for a system which has been in use in France for two or three years past, however, on a smaller scale. The principle of this invention is that the power of the mercury or aneroid is only used as a governor to allow two trains of wheels to run, one to carry the hand up and the other down in sympathy with its own rise and fall. Consequently it is the power driving the two trains of wheels which limits the size of the hands, and this can, of course, be increased to any extent. One of these barometers has been in operation for some time at Princes Club, Hans Place, with two dials, each 3 ft. 6 in. diameter, and another with two dials, 8 ft. diameter each, at the Royal Aquarium, Westminster. One of them is inside the building 20 ft. above the instrument which drives the hand, and the other outside at a much greater height, four pairs of bevel wheels and many feet of connecting rodding being used. The system has successfully withstood the severest tests for months.

An illustrated detailed description of this invention will be found in another part of our Journal.

English Watches on the American System.—Since the introduction of American watches into the English market, several English makers have commenced to manufacture watches on the same principle. The usual objection to them, however, has been that they have not retained the characteristics of the English watch. We learn, however, that this difficulty is being entirely obviated, and were recently shown a very superior article, on the American system, manufactured by Mr. Michael, of Coventry, and which retained the leading characteristics of an English-made watch, with the exception of having the going barrel.

OIL TEST.

Mr. W. H. BAILEY, of the Albion Works, Salford, in a valuable paper on the testing of lubricants, read before the Manchester Association of Employers, Foremen, and Draughtsmen, gives a description of his *Pendulum Test* for fluidity and oxidation, which will be found useful in testing oils which will not be subjected to heavy pressures, such as the conditions under which oils will be used for clocks and watches. As will be seen by accompanying illustration, it consists of a pendulum to which is attached a link, which imparts a reciprocating motion to a small piece of brass. By simply placing one drop of oil on the surface of the brass, and noticing how many times different oils will permit the pendulum to vibrate without stopping, useful information may be obtained about the value of a lubricant when not subjected to heavy wear and tear. The behaviour of an oil may be also noticed when subject to atmospheric influences, by taking note of the different vibrations, with one, two, or more days of an interval; it may thus indicate any process of deterioration and any incapacity to resist oxidation and tendency to become varnish.



Illustrated Catalogue of Masonic Regalia, &c.—A handsomely illustrated price list of masonic jewellery, gold lace, embroideries, insignia for societies, &c., has recently been issued by Mr. Geo. Kenning, Masonic Jeweller, of 1, 2, and 3, Little Britain, London, which will be appreciated by everyone in the trade. The catalogue contains beautifully illustrated designs of every article required in the craft, and is of itself a work of art, produced in a superior and highly creditable manner.

Mr. Thomas Alva Edison, the inventor of the phonograph, is said to have lately succeeded, by extending the application of the phonographic principle, in constructing a clock which, instead of striking the hours, announces them in a human voice, and adds appropriate remarks.

TRADE RECIPES, &c.

To Bronze Iron Articles.—Iron articles to be bronzed are, according to a process by M. H. Hess, heated in the air after being coated with linseed oil. Objects which cannot be exposed to high temperature may be steeped in a slightly acid solution of ferric chloride, plunged in hot water, and when dry rubbed with linseed oil or with wax. To preserve iron from rust the author recommends sulphite of copper. He steeps the iron for a few minutes in a solution of sulphate of copper, and then transfers it to a solution of hyposulphite of soda, acidulated with hydrochloric acid. The result is a blue-black coating, not affected by air or water.

Black Enamel is thus made :—Peroxide of manganese 3 parts, zaffre 1 part ; mix, and add as required to white enamel, which is : washed diaphoretic antimony 1 part ; fine glass, free from lead, 3 parts ; mix wet, pour into water, powder, melt again, and repeat this three or four times.

Grinding Glasses.—Provide two pieces of cork, one concave and one convex (which may be cut to shape after fitting to lathe). Take a copper coin or other suitable article and soft solder a screw to fit the lathe, and then wax it to the cork ; then get a twenty-five cent emery wheel, such as is used on sewing machines, and you have a complete outfit for cutting your watch-glasses. Polish the edge on the zinc collar of the emery wheel, or use a piece of zinc to do it. The other cork should be waxed to a penny and centred. The spectacle lenses may be cut on the same emery wheel, if the wheel is attached to the lathe so as to revolve. Another method is to take a common piece of window-glass (green glass is the best), and make a grindstone of that, using the flat surface to grind on. Cement it on a large chuck, the glass being from 2 to 2·5 inches in diameter. Anyone not familar with this method would be surprised to see how fast the glass is cut away, for either spectacles or watches. In grinding watch-glasses put them flat on the chuck-glass, not on the edge.

How to Temper Lifting Springs.—After the spring is fitted, draw-file it, and harden in oil. Then put it in a spoon, cover with sweet oil, hold over a lamp until the oil takes fire, passing it over the lamp at intervals to keep it burning, and let the oil all burn out. The author of this method states that he has employed it for over ten years and never knew a spring to break. He thinks, however, that the oil used, namely, sweet oil, may have something to do with his success.—*Rèvue Chronométrique.*

A German Method of Gilding.—Prepare gold powder as follows :—Put as much fine gold in aqua regia as the latter will dissolve ; then let the solution be absorbed by fine linen rags and dry them. When perfectly dry, burn the rags to ashes, and a very fine metallic gold will thus be obtained. If a red gilding is wanted, a little copper must be added. The correct proportions are : 6 parts of fine gold, one part of pure copper, and 16 parts of aqua regia. Articles to be treated in this manner should be well cleaned and polished before gilding. This done, char one end of a cork, and wet this end with salt-water or vinegar, dip it into the gold-ashes, and then rub the metal surface with it. This must be continued until the desired gilding is obtained. A beautiful polish can then be produced by means of a bloodstone or polishing-steel, kept well moistened with soap-water (rain). Care should be taken not to touch this gold solution with the fingers.

To protect Dial Plates on which Holeing, &c., has to be done.—Mons. A. Cadot, of Paris, gives the most simple method for securing dial-plates from injury while operated upon, and many a watchmaker will, no doubt, wonder why he did not think of it before : Cut a sheet of paper the size of the dial, and glue it on to the dial plate after cutting through the paper an opening corresponding to the engraving, &c., which is required. Make the holes the proper size with a graver. Crushed pumice will serve for etching and rounding the angles, when the whole is polished with enamel powder or diamantine. The plate has then only to be put in water and the paper falls off. This method will give great satisfaction, as it is thus impossible to scratch the dial.

A Simple Electroscope.—Mons. Rameaux lately brought before the Société des Sciences of Nancy a very simple and sensitive electroscope. It consists of a fine fibre of white silk, fixed at one end by means of a little wax to any support, and free to oscillate in any direction under its point of attachment. A single thread would, of course, suffice for the ordinary purposes of electroscopy properly so called, but it is preferable to employ two near each other, taking care to space them so that they cannot foul each other during their swing, or influence each other reciprocally. One of the threads is charged to strong repulsions by means of a glass rod charged with positive electricity ; the other is charged in a similar manner with a stick of resin charged with negative electricity. Every body which attracts one of the threads so charged, and repels the other, is necessarily electrified. Its electricity is of the same sign as that of the thread which it repels. The sensibility of these electroscopes is greater within certain limits, as the threads are made finer, longer, and less conducting. If the finest sewing silk of commerce be untwisted, each of the parts or strands obtained will make an excellent electroscopic pendulum, which, if about sixty centimetres long, is very handy, and suffices for almost all tests. White silk is preferable to coloured. The motions of the threads, if well charged, are very considerable, even when the bodies presented to them contain but slight charges of electricity. When the threads are not excessively fine, disturbances of the air do not destroy the observations so much as might be supposed. In the first place, these disturbances can be almost entirely removed ; and furthermore, the threads, even when agitated, obey so well any electric attractions and repulsions that it is absolutely impossible to mistake or detract from their evidence. Mons. Rameaux has found this arrangement in all cases more sensitive and sure than a carefully constructed gold-leaf electroscope, which he used for comparison. This system also recommends itself in several ways. For instance, it is so simple that every one can construct and use it. It costs nothing ; no special support being necessary, the thread can be fixed to any projecting piece, as the edge of a table ; the only condition being that they may hang freely. It can be set up in a moment, and consequently is at once ready for any unexpected requirement ; whereas a gold-leaf electroscope, long unused, requires to be dried for hours. It works perfectly, whatever the hygrometic state of the atmosphere. It can be employed to show electric phenomena to a numerous auditory. With long, thin fibres, and highly electrified bodies, the experiments are very telling.—*Bulletin de l'A. S. de France.*

Cleaning Clocks and Watches.—A new method of cleaning clocks and watches suggested by W. W. Thompson consists in removing the movements from the cases, and immersing them in pure naphtha or other volatile liquid ; and drawing or twirling them about in it, so that the naphtha will dissolve and wash away everything adhering to any of the parts. The mechanism should then be dried in hot air, and gradually cooled. It is alleged that by this process timepieces may be thoroughly cleaned without separating the work.—*Scientific Record*, 1873.

Cementing Metal to Glass.—Take two parts finely powdered white litharge, and one part of dry white lead, mix intimately, and work up with boiled linseed oil and lac copal to a stiff dough. One part of copal is taken to three parts of boiled oil, and enough litharge and white lead added to make a dough, similar to putty. The under side of the metal is filled with the cement and then pressed upon the glass, the excess of cement being scraped off with any sort of instrument. It dries quickly and holds firmly.

THE GOLDSMITHS' HALL MARK AND DUTY ON SILVER PLATE.

By Josiah Williams, Bristol.

MY attention has been called to a pamphlet written upon this subject by Mr. E. J. Watherston, of Pall Mall, London, and to which the attention of the editors of some of our leading journals has it appears been also invited.

I have not the pleasure of knowing Mr. Watherston, but I am informed that he is not a manufacturer of silver plate, and if this be true it is but fair to presume that his views are drawn from theory rather than practice.

Believing, as I do, that many of the editorial remarks that have been made in favour of Mr. Watherston's views are founded upon an imperfect knowledge of the subject in all its bearings, and are calculated to mislead the mind of the public, I venture to offer some observations upon the question, so as to place the matter, as far as I am able, in its true light before the trade and the public.

For more than half a century mine has been a manufacturing house of silver plate, and it is my opinion that the duty on silver does *not* militate against the prosperity of the trade. But whether the duty be continued or not, it is most important that the existing Halls should be maintained in their integrity, for the purpose of assaying the manufactured wares; and that the present laws which compel manufacturers to send every article they make, with few exceptions, above the weight of 2 dwts. to the Halls, be continued in full force.

The advantage of the scrutiny every article undergoes at the Halls cannot be too highly valued, for in that way only can an efficient guarantee be given to the public that the silver they purchase is of the standard quality. In fact, without the Hall mark, the silver trade would be ruined; for in these days of imitation no person could be sure he was purchasing the genuine article unless it bore the Government stamp or Hall mark, which certifies that it has undergone proper inspection, and is of the standard quality.

My fear is, and I think it is reciprocated by most manufacturers, that if the duty be repealed, the present laws for preventing fraud will in time get relaxed, and the effect of that would be most disastrous to the high character of English silver, and prove most prejudicial to the trade; for the withdrawal of the duty would be equivalent to the withdrawal of the guarantee afforded by the supervision of Government, which would be found in practice the only power that could deal effectually with fraud.

Most of the arguments that have been used against the duty seem to me very fallacious. Take first our foreign trade. The duty on silver is an inland revenue, and when silver goods are exported it comes off; therefore I contend that the abolition of the duty would have no effect whatever in increasing our foreign trade. We ourselves export annually many hundreds of ounces, and we have never found any difficulty in so doing, the cost being very trifling. I would observe, in passing, that here again the advantage of the English Hall mark appears, it being a recognised guarantee all over the world.

Then as regards our home trade. Here lies the only argument in favour of its abolition—viz., it would cheapen new silver a little; but only a little in comparison with the entire cost of the article. The assertion that "40 per cent. would be saved to the purchaser of silver goods if the duty were taken off," is an exaggerated statement. Take as an example a tea and coffee service, weighing 80 ozs., which would be sold to the public for £50; the duty on this is £6, which if deducted leaves £44. Now I ask, in fairness, how many more silver services would be sold because they could be purchased £6 cheaper? It must be borne in mind, that it is not the poor who buy such things, but the rich, so that it would not affect the great masses of the people. Silver is a luxury in which only the wealthier classes indulge, and who should pay taxes if they do not?

It has been stated that manufacturers "hug the tax," because they get something out of it. This to my mind is absurd reasoning; the manufacturers' profits are so fine that they could not afford to lose any portion of them; therefore whatever profit they get from a rebate of a portion of the duty would, if repealed, have to be charged upon the goods. Again, the Halls now get a percentage on the duty, which goes to defray expenses; if this were taken away they would have to charge more for marking the silver wares, and that also would have to be charged upon the goods, so that the saving to the public would in these two ways be considerably reduced below the 1s. 6d. per ounce. I think it would be found to be much nearer 12 than 40 per cent.

Mr. Watherston in this, as in other arguments, is illogical, for while, on the one hand, he states that the manufacturers "hug the tax" because it is a source of profit, he states, on the other hand, that the duty militates seriously, and has deminished our export trade. Now if our manufacturers obtain a profit by the duty—and the full amount of duty is rebated on exported goods—it is clear that the English manufacturer would thereby be placed in a position of advantage over the manufacturer of other countries—in fact, the English manufacturer of silver plate would be in a similar position to the present French sugar manufacturer.

Another argument has been adduced by the advocates of the abolition of this duty:—viz., that of late years the quantity of silver work made in England has fallen much below what it was formerly. I have not all the statistics by me, but granted that such is the case, I think the true explanation will be found, not as asserted, "that the trade has been cramped on account of the duty," but that the introduction of electro-plate has in a great measure superseded silver. The former has all the appearance and utility of the latter, at about one-sixth the cost; and although it will only last for a time, while silver lasts for ever, the preference for the most part is now given to electro-plate, on account of its comparative little cost, and the additional advantage of its being no temptation to thieves. I speak from the experience of my own firm, and I have no doubt the statistics at the Halls will bear out the fact, that the demand for silver fell off in proportion as electro-plate came into use, and therefore I consider it absurd to trace the diminution in the demand for silver to the action of the duty. And further, I am of opinion that if the statistics be obtained from the Halls of the *articles* marked, it would be found that there are more hollow and fancy silver articles made in England at the present time than at any former period; and that the diminution of quantity of ounces marked arises in no small degree from the lessened demand for the heavier class of silver goods, the taste of the present day being in favour of lighter, more tasteful, but less substantial articles. I may mention in favour of this view, that the quantity of silver marked at the Sheffield Hall for the last five years is 492,594 ounces, as against 410,462 for the five years 1856 to 1860 inclusive; while the Birmingham Hall shows an increase of more than 50 per cent.—the quantity from 1856 to 1860 being 421,729 ounces, while from 1873 to 1877 it was 689,268 ounces. Now as the articles marked at these Halls are for the most part hollow work, of a light and ornamental character, as compared with spoons and forks, which form the bulk of the work marked at the other Halls, it goes far to prove that while the *weight* in the aggregate has diminished the number and variety of articles have increased.

It must also be borne in mind that many countries which we used to suppy with silver goods are now manufacturing their own; this fact, unfortunately for English manufacturers in general, has a wide application. It however has nothing to do with the duty, for, as before stated, it is taken off on exportation. Reference has been made to the quantity of silver manufactured in America. I cannot see what that has to do with the question.

America is a comparatively new and growing country, and as the people increase in wealth they purchase silver plate; in England the rich people are for the most part old families, whose plate is handed down to them from generation to generation; therefore their requirements for new plate are very limited. To found an argument for the abolition of the duty in England upon the prosperity of an American manufacture, lacks soundness, when the duty paid in England is, as I have shown, no hindrance to our selling in the foreign market. If it can be shown that the abolition of the duty on silver would benefit the British manufacturers, their own interest would of course impel them to join in an endeavour to get it repealed; but as yet I consider the arguments put forth by those who are seeking such a repeal very unsound, and I utterly fail to see, as has been asserted, "that the present tax is one levied in the interest of the foreign manufacturer."

I will now refer more especially to the question of the Halls. Mr. Watherston, in his pamphlet, asserts that he does not seek to do away with the halls—in fact, he tacitly admits their importance as a necessary guarantee to the public; yet in his letter published in the February Number of the Watchmaker, Jeweller, and Silversmith's Trade Journal, he advocates the repeal of the very laws that guard the public against fraud, and under the plea of free trade, would introduce foreign-made silver articles into this country, without subjecting them to the scrutiny of our Halls, so that the purchaser would have no means whatever of knowing the quality of the silver he was buying; for the standards of all nations are not uniform, and but few are equal to our English standard. Manufacturers and refiners know from experience how difficult it is to judge of the value of foreign-made silver goods without assaying them, and this practically is beyond the reach of the public. Under this head let me allude to French wares, which some are seeking to introduce into this country. In France the manufacturer has the option of using silver with either 5 per cent. of alloy or 20 per cent. of alloy, and although nothing commoner than this is allowed for home consumption, he can use still lower standards for export. Now, if French silver is to be brought into this country containing 20 per cent., or more of alloy, and our standard is limited to 10 per cent., it is no wonder that those who are seeking to introduce it should object to the supervision of our Halls. If the manufacture of gold was restricted in this country to 18 or 22 carat, and a free importation allowed of foreign make of 9 carat, it would be simply unjust to the English producer and to the public. There is no legal hindrance to the introduction of foreign-made silver goods into this country, *providing it is equal in quality to our own make, and pays the same duty.*

It is argued by Mr. Watherston that a removal of the duty would not weaken the protection afforded to the public as a guarantee against fraud, but a very casual observer would see that while a duty exists it is to the interest of the Inland Revenue to look after and punish defaulters, and if the supervision of their officials was removed, it would simply rest with the public to detect and prosecute such—*e.g.*, there is no duty on jewellery, and as a consequence the mark on jewellery is found ineffectual as a guarantee. Feeling this, the Council of the Society of Arts published (in the *Ironmonger* of 1873) an invite for essays treating on the subject, from which the following is a quotation: "It having been brought to the knowledge of the Council of the Society of Arts that what is termed Hall marking of jewellery is inadequate to secure to the public that protection in the quality of the materials for which it is intended, they have accepted the offer of one of the members, Mr. Edwin W. Streeter, to place £25 at their disposal, to be awarded as a prize for an essay treating on this subject, with suggestions for an improved system." I do not wish it for a moment to be supposed that I am charging the manufacturing jewellers with wrong doings, but where there is a loop-hole fraudulent makers will always be found to take advantage.

Mr. Watherston says: "Other trades have no such restrictions, why should the silver trade be so hampered?" I contend that the silver trade is peculiar, and fraud so difficult to detect, that the law is of necessity stringent and severe; but this only affords a better protection to the public, and has been upheld rather than objected to by every honest manufacturer for the past five hundred years. In strict language the silver trade cannot be said to stand alone in this particular: the tobacco trade pays a heavier duty, and is, perhaps, more "hampered" than the silver trade, and although a luxury, not the rich but the masses pay the tax. Yet I doubt not, *if fairly put*, ninety-nine out of every hundred would prefer paying threepence per ounce for their tobacco and know that it was genuine, than obtain it for half the money with the probability of a great portion being lettuce leaves, or something worse. In point of fact a person by paying the duty ensures the supervision of the Excise to secure for him genuine tobacco, and if he can afford the luxury at all, he can afford to pay the tax. The same argument applies to the silver trade: any one who can afford to pay seventy or eighty shillings for a dozen of silver tea-spoons, can afford to pay ten shillings extra to ensure an article of the quality he pays for, and, as before stated, the Hall marking would not secure this so effectually if the duty were removed.

I will now refer to a remark in Mr. Watherston's pamphlet. In alluding to the repeal of the duty in 1758, he observes "that it may therefore be presumed that the tax had even in these days been found to be depressing in its effect upon the trade." I think any one who will take the trouble to read the Act will admit this argument to be illogical and unsubstantiated by facts. The duty then in existence was repealed "in consequence of its provisions for ascertaining and collecting the duty being found ineffectual," and as a substitute a duty for licence was imposed on dealers in plate; but even this it was feared would so injuriously affect the trade that "*death without benefit of clergy*" was introduced to ensure against fraud and abuse.

Mr. Watherston has sought to elicit the sympathy of the encouragers of the fine arts by stating that the duty on silver is an obstruction to the development of art work. But this delusive argument must vanish before other more correct and potent reasons for the avoidance of the use of silver by the art student. The expense of material, and the loss on waste added to his work, would place the product out of the reach of all but the most wealthy. To pay for art workmanship a material inexpensive must be used, that the price may secure purchasers, and quantities be sold. It cannot be argued that single articles of high art work may be sold in silver as a painting or piece of sculpture, for who would care to give a fabulous price for an article that the first petty thief could melt down to sell as old metal?* Stone or canvas has no intrinsic worth, and bronze is not worth stealing. Let any manufacturer be asked, and probably few would be found who had not tried the experiment, whether high-class art goods can be sold in silver? A few may be made as show articles, but where are the purchasers? To say the tax is the cause is simply absurd. Would a tax of 10 per cent. or 15 per cent. on the *materials* of a *painting* or piece of sculpture prevent or hinder its sale? Thus it will be seen that the expense of the material itself, and its ready disposal of as old metal, are the two real hindrances to high-class art work in the precious metals. As to technical education, the scope in electro-plated wares is so great that *it* presents no hindrance, and the working of silver and German silver is so similar that the instruction to the student in the one would be applicable to the other.

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* As a case in point the medals, anciently issued to commemorate national victories and events, though used as money, are comparatively plentiful at the present day, and enable historical students to elucidate many of the facts of ancient times. They have been preserved because the material was bronze or copper, while many choice medals of modern days, being made of gold and silver, have been lost to our posterity, because the value of the metals made them objects of desire to thieves or met the need of the impoverished descendants of those to whom they were presented.

Looking at the question in all its bearings, I have arrived at the conviction that a repeal of the duty would not benefit the English manufacturer, would be no material advantage to the public, and would incur a loss to the revenue of £50,000 per annum; while any relaxation of the laws that now regulate the silver trade would seriously impair the security the public now enjoy against fraud.

Since writing the foregoing, my attention has been called to the statistics published in the *Journal of the Society of Arts*, 17th March, 1876, from which it appears that in the year 1866 (the year of the great commercial panic) the export of silver fell off from 133,160 ounces to 97,093 ounces, and in the year following there was a still further decrease of 180 ounces, while our home consumption decreased during these two years 43,200 ounces. But from the year 1873 there has been a gradual recovery—the export during the year 1875 being 120,280 ounces, showing an increase of 23,467 ounces over the year 1867, and an increase of 84,400 ounces between the same years on our home consumption. The full amount marked at the Halls in 1875 was 886,493 ounces, against 858,173 ounces in the year 1865; showing an actual increase in our home consumption during these ten years of 41,200 ounces; and an increase on the full amount marked at the Halls of 28,320 ounces.

BOOK NOTICES.

Treatise on Modern Horology, in Theory and Practice. Translated from the French of Claudius Saunier. By Messrs. JULIEN TRIPPLIN, and EDWARD RIGG, M.A.

Part II., now ready, contains: Theoretical and practical considerations concerning the moderator and regulator—The retention of oil at contacts—The lead—The lifting arc; supplementary arc—Length of the impulse arm and arm of rest—On the nature of the several kinds of friction; useful friction; engaging and disengaging friction. With this Number concludes the introduction to the study of escapements, and with the verge escapement begin Mons. Saunier's incomparable treatises on the various escapements. A tabular summary of the general mechanical principles which bear on escapements is also added, and will be found very useful.

We are glad to hear that this publication has already met with such support as to ensure its success, and we have no hesitation in asserting that it will materially assist in raising the standard of our workmen by disseminating a more general knowledge of the laws of physics and mechanics, so essential to a perfect understanding of the art of Horology.

The History of Clerkenwell.—This most interesting of local histories, by the late W. J. Pinks, is being republished in a popular form by Mr. C. Herbert, of 60, Goswell Road, under the able editorship of Mr. E. J. Wood, the well-known authority on horological antiquities, who has enriched the original by valuable additions and interesting notes. It is issued in thirty sixpenny parts, to be had monthly or bi-monthly to suit the convenience of subscribers, and when complete will form a handsome volume of upwards of 800 pages, illustrated with 200 woodcuts and full-page engravings. The History of Clerkenwell is particularly rich in historical, social and archæological records, and we can heartily recommend this work to all lovers of antiquarian literature.

THE Goldsmith's Company has given a donation of £25, the Mercers' Company £10, and the Merchant Taylors £10 10s., to the Cabdrivers' Benevolent Association, 15, Soho Square, as contributions to the annuity fund for aged or infirm cabmen who are members of the association.

CO-OPERATIVE WATCH MANUFACTURING.

BY A "WORKING WATCHMAKER."

AS many of our readers are doubtless aware, an attempt is being made in Coventry to organise the watch trade upon a principle which, while holding no hostility and entering into no rivalry with the trade as at present carried on, seeks to reconcile all interests on the basis of co-operation, giving to the capitalist fair interest for his money, and to the worker and customer equal shares with him in profit derived from their joint action. Whether this attempt will prove ultimately a great success or no, it is at least well worth while making the endeavour to place employer and employed upon a plan where their interests are thoroughly identical. No doubt, to some extent, in ordinary trade, they are so now, but not wholly, and this diversity of interest leads to continual strife with the employer to get as much labour as possible for money, and the workman to give as little, with the dreadful contingencies of "strikes" and "lock-outs" as weapons of war for either party to use upon the other, and alas! too often with dire and fatal effect. Co-operation will not, and is not intended to prevent honourable rivalry, which will always be necessary to stimulate men to put forth their best energies, but to gain the workman's good-will to do his best in an enterprise where he will share in the gains in proportion to his pains. But this, it may be said, is all very well in theory. If so, it will be well to try it in practice, and to arrive at this was the aim of the promoters of the Co-operative Watch Manufacturing Society, which was commenced, not by theorists, but by workers. It is the custom of our cousins on the other side of the Atlantic to "blow" a great deal about their achievements, and in their so-called machine-made watch they have in this respect even surpassed themselves. Yet if there be anything in their method superior to ours by the aid of co-operation, that method can be as fully carried out by us as by them; only theirs being merely on the joint-stock system, does not give such strong motives for united action. We ask the industrious and thoughtful watchmaker to come forward and help in this enterprise in his own interest and that of his trade, assuring him that he will find already enrolled in this endeavour men who work in this course not without hope.

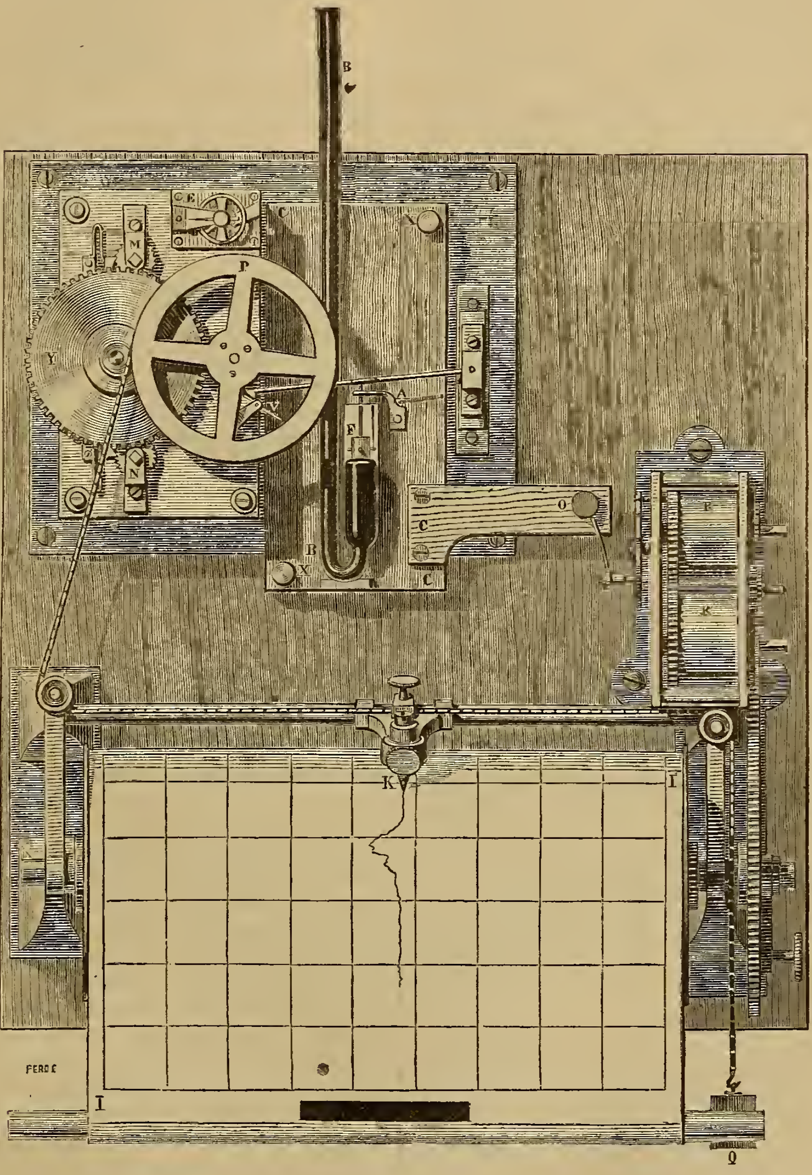
I am pleased to learn since the foregoing was written that the Society has held its third half-yearly meeting, which took place at the registered office of the Society, 45, Bishop Street, on Thursday, the 14th of February last, when it appeared from the balance-sheet then read that after paying current expenses, and making up for loss previously incurred, the Society was enabled to pay $2\frac{1}{2}$ per cent. on subscribed capital from the commencement, which already places its subscribers in pretty nearly as good a position as if their money had been placed in a Post Office Savings' Bank. This I think will be admitted by practical men to be pretty fair for a young Society to do in the face of declining trade.—*From the "Coventry Co-operative Record" for March.*

SOME very fine and rare examples of antique jewellery and ring money have recently been added to the collection of antiquities in the Weston Park Museum, Sheffield. The ring money, which is chiefly in gold, is varied in form, and some pieces are of considerable weight. The greater portion of the jewellery consist of brooches or fibulæ, in gold, silver, and bronze, of the Anglo-Saxon period. Many of the gold brooches are set with stones, principally garnets, and evince considerable taste. There are numerous examples of Irish pin fibulæ, and two large and elaborate Irish silver brooches. There is a beautiful Anglo-Saxon cross, ornamented with filagree work, and having a garnet cut in facets set in the centre and a remarkably fine circular Saxon brooch of gold, finely ornamented with filagree work.

REDIER'S RECORDING BAROMETER.

THE amount of motive force which variations in the weight of the atmosphere communicate to an apparatus, even when the elements of the machine are increased to the utmost, is very small and inadequate to conduct a needle of any weight, or a tracing-pencil. But let us suppose a strong clockwork, provided with a motor which requires rewinding from time to time, carrying the needle or drawing the pencil, and the movements of this wheelwork directed by a mercurial or Aneroid barometer. In this case the barometer is the soul of the instrument; the wheelwork with its strong motor would follow all its indications, and the extent of the functions demanded of the apparatus would then be illimited.

Let us take the case of the mercurial barometer. An ordinary siphon barometer, BB, is mounted on a small board, CC. This perfectly independent barometer is fixed on the instrument by means of two polished pins, XX. A small ivory float, bearing a delicate vertical steel rod, lies in the mercury; and a very light needle, A, ending in a small hook, rests on the upper end of the float's steel rod. By the side of the barometer are two clock-works, M, N. The one wheelwork, M, terminating in a lever escapement, moves to the right; the other, N, ending with a fly V to the left; and are so applied, that the speed of the escapement is one, and that of the fly at least two. A differential train connects this double wheelwork, and the axis around which the satellite of the train turns carries wheel Y which again catches with a pinion under the pulley P. The axis of pulley P also carries a pinion, invisible in the figure, which catches with a curb fixed in such a manner under plate CC of the barometer that when the pulley is set in motion by one of the wheelworks it also imparts movement from the top downwards to the whole of the siphon barometer.



When the two springs of the movements M and N are wound up, the following takes place:

Escapement E moves continually, and its motion draws the pulley carrying the chain of the tracing-pencil K, and causes plate CC to move upwards. The needle A, pushed by the small rod of the float F, follows the movement, its small hook liberates the fly, and the latter begins to turn. The speed of the fly V being twice that of the escapement, the wheelwork driving the former turns the pulley in the opposite direction, and makes plate CC descend till the hook of needle A again arrests the fly.

These successive movements are indicated on paper by an uninterrupted line, which is straight as long as the barometer does not vary, but inclines to the right or left if a downward or upward motion takes place. If the mercurial column descends in the small branch of the siphon, which corresponds to a rise, the fly remains hooked for a longer period, and the time required by the escapement in effecting its liberation is marked on the paper by a stroke, the length of which is in proportion to the quantity of additional pressure. If an Aneroid barometer is employed a large rack should take the place of the curb, and things will then go as before.

The *Recorder* consists of a clockwork RR′ with two motors. R leads a cylinder on which the paper rolls itself, and R′ is made to strike three slight blows on a small board attached to the barometer without shaking the mercurial column, in order to overcome the resistances of capillarity. Let a needle of a good length be fixed in the place of pulley P, and we have a dial barometer, which can be read at great distances, an arrangement which Messrs. Lund & Blockley have applied to the tower of St. Mark's Church, West Hackney. The value and fitness of its application to public monuments and sea-ports requires no further explanation.

These apparatuses work with an exactness which brings any differences within a tenth of a milimeter. One turn of the cylinder is equal to three days' motion; but if sheets of longer duration are wanted, they are disposed, as shown in the figure, and an indefinite length may be obtained. As the thickness of the paper alters the regulation by superposing to keep accounts of these differences, it is, however, desirable to have six-day slips only.

GOLDSMITHS' AND JEWELLERS' ASYLUM.

THE half-yearly meeting of subscribers of the Goldsmiths' and Jewellers' Annuity and Asylum Institution was held at the North London Schoolrooms, Calthorpe Terrace, Gray's-inn Road, for the purpose of presenting a report of the committee and balance-sheet, to elect three male and two female annuitants, and to appoint persons to serve on the committee in room of those retiring by rotation. Mr. George Lambert, F.S.A., occupied the chair.

The report stated that it had been issued under unusually favourable circumstances. The year 1877—the jubilee year of the Institution—had been distinguished by liberal subscriptions from members of the trade and other friends, in addition to the large number of which the Worshipful Company of Goldsmiths had been most conspicuous for their liberality, not only for the munificent donation of £500 invested in Stock on the day of the 50th anniversary, in April last, and for giving the use of the Company's dining-hall for the jubilee dinner, but for adding to the funds about £150 in generously bearing the expense of the banquet. The committee thanked all who have assisted in making efforts to relieve their fellow goldsmiths, and the co-operation of those who had not yet contributed to the funds was earnestly invited. The auditors' report showed that the payments to annuitants had increased by £49 8s. 4d. over the previous year; the subscriptions amounted to £2,157 19s. 3d., making an increase of £1,231 18s. 3d. on the sum received in 1876. Over £700 had been given to annuitants. The total present funds of the institutions, including investments, was £7,430 1s. 1d.

The Chairman said the large increase which the auditors had announced was quite unexpected; but he hoped subscribers would not relax their efforts in consequence, and rather let it act as an incitement to further efforts. They would not always have a jubilee year, and he asked every one present, and those who were absent also, and felt an interest in the benevolent work, to do their utmost to enhance the usefulness of the society.

On the motion of Mr. J. H. Gibson, seconded by Mr. Saunders, the report was adopted, and thanks were voted to the auditors.

The Chairman then announced that the following persons had been duly elected annuitants:—Henry Hopkins, 69, working goldsmith, 4,058 votes; Joseph Coppendale, 71, coral carver, 3,503; W. J. Taylor, 66, working goldsmith, 3,491; Charlotte Wolfe, 56, widow, 4,035; and Anne Ersser, 83, widow, 3,828. The members appointed to serve on the committee for the ensuing year were—Messrs. Coop, Stanley, Main, Shrimpton, Ball, Walker, D. Currie, Harper, Bennee, Wayland, Lawrence, Wolfe, Duncan, and Fairburn.

After a vote of thanks had been accorded to the chairman, who responded, and a similar compliment had been awarded to Mr. W. Brown, the secretary, the proceedings terminated.

WEDDING GIFTS.

WE do not think we have ever heard of a more magnificent array of jewels and jewellery than those presented to Miss Hannah de Rothschild on the occasion of her marriage with the Earl of Roseberry.

Foremost among them are the Roseberry family jewels, comprising a tiara, comb, collet, pear-shaped ear-rings, and cross of brilliants, balanced in the centre of the splendid group by a new parure of brilliants, formed of a tiara of large stones, a double-heart bracelet, with two drop-shaped stones, a bracelet of three rows, a necklace of three rows, with clustres at the sides and back, and a pair of ear-rings. Next in order must be noticed a magnificent pearl necklace of five rows, the snap being a portion of the family diamonds. Then a *bouton* suite, consisting of a bracelet of eight large pearls, each surrounded by brilliants, a brooch formed of one superb pearl in a double circle of brilliants; and, lastly, ear-rings of the same character. The next present from the bridegroom is a large brilliant spray brooch, in form of a "rose berry." A pendant containing a very large and deep-coloured sapphire and fine pearl, set with brilliants, is another attractive object among the new jewels, which are completed by four gem rings, severally composed of rubies, emeralds, sapphires, and diamonds, all being large stones. Historically prominent, as well as artistically beautiful, in this central display of presents from the Earl to Miss Hannah de Rothschild, are the exquisite box of enamelled gold surmounted by a portrait of Marie Antoinette; a painted fan which belonged to that unfortunate Queen; and an old Italian mirror, with pair of candlesticks, the silver work being wonderfully elaborate and minute.

First among the gifts of friends and relatives we may mention a sapphire and diamond aigrette of rare beauty; a brilliant rosebud brooch; a bracelet, the centre stone of which is a large and symmetrical pink pearl; a gold-mounted agate box of implements; a spray brooch of pearls and brilliants; a pair of long ear-rings, of rubies, and diamonds; a pair of brilliant snake ear-rings, with pearl drops; a brilliant flower bracelet; a brilliant and pearl pendant; a pearl and brilliant flower brooch; a brilliant snake brooch for holding flowers—a spray of orange blossom being already placed therein; a turquoise and brilliant butterfly brooch; an emerald and brilliant snake brooch; a necklace of small pearls, with diamond-capped tassels; a ruby and diamond eglantine brooch and ear-rings *en suite*; sapphire and diamond ornaments; a pair of turquoise and brilliant ear-rings, and a pendant to match; a pair of ear-rings, of pearls, and old-set diamonds; a pendant of brilliants, with the monogram of the bride in those stones on a central amethyst; also a turquoise and diamond ring presented by the Earl of Beaconsfield.

ANSWERS TO CORRESPONDENTS.

R. I., Edinburgh.—Jeweller's Glass Scratch-Brushes may be had from Messrs. Clements, Handley, & Co., of 19, St. John's Square, Clerkenwell, London.

WATCH CASES (HALL MARKING).

THE following is a copy of a Bill introduced into the House of Commons, and ordered to be printed on March 13th. The Bill bears the names of Sir Henry Jackson, Mr. Eaton, Sir Andrew Lusk, Mr. Torr, and Torrens.

"A BILL to Amend the Law relating to the Hall-marking of Watch Cases.

"Whereas the hall marks impressed by the corporations authorised by law to assay and mark gold and silver plate in the United Kingdom have by usuage become distinctive of articles of British manufacture only, notwithstanding that those corporations are not legally entitled to refuse to mark articles manufactured out of the United Kingdom; and it is expedient that these hall marks be made so distinctive by law:

"Be it therefore enacted by the Queen's most Excellent Majesty by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

"1. This Act may be cited as the Hall Marking Act, 1878.

"2. This Act shall commence from and immediately after the *thirty-first day of December, one thousand eight hundred and seventy-eight.*

"3. The corporations authorised by law to assay and mark gold and silver plate in the United Kingdom shall not assay or mark any watch case which is not manufactured in the United Kingdom.

"4. If the assayer of any such corporation has reason to believe that any such watch case sent to his assay office for the purpose of being assayed and marked has not been manufactured in the United Kingdom, he shall not essay or mark the watch case until there has been produced to him a declaration made and signed before a justice of the peace or some person authorised to administer oaths in the Supreme Court of Judicature, and stating that to the knowledge of the declarant the watch case has been manufactured in the United Kingdom.

"5. If any person knowingly and wilfully makes any false statement in any such declaration, or sends or uses as genuine any declaration purporting to be made under this Act, knowing the same to be false or falsified, he shall be guilty of a misdemeanour, and shall be liable to imprisonment for any term not exceeding *two years*, with or without hard labour, or to a fine not exceeding *one hundred pounds.*"

INLAND REVENUE PROSECUTIONS.

Recently Messrs. Pickford and Wright, jewellers, 178, Upper Street, Islington, were summoned for dealing in plate without a proper licence.

Mr. H. Powell, barrister, who prosecuted on behalf of the Inland Revenue Department, said it would be proved that the defendants sold a gold chain weighing more than 2oz., having a licence to sell only up to that weight. The officer who bought the chain received at the same time a notice to the following effect: "It having been decided in the Court of Exchequer by Chief Baron Cleasby that a jeweller cannot sell over 2oz. of gold with a 40s. licence, take notice that this article is sold as an 18-carat chain: that is, three parts of it are gold, and one part copper, and it can be purchased as a copper and gold chain or a gold and copper chain at the option of the buyer. (Signed), T. Pickford." The chain in question consisted, as shown by the Hall-mark, of 18dwt. of gold to 10dwt. of copper, and the gross weight was 2oz. 9 dwt. This case was almost on fours with that of "Young *v.* Cooke," the only difference being that in this case the officer had notice that the chain he was buying was an alloy of gold and copper. The point to which he had referred would, he thought, be met by the words of the Lord Chief Baron, who held that the gold must be considered to be the gold of commerce, an opinion in which he was supported by his brother Cleasby.

For the defence, Mr. Thomas Pickford Wright, one of the firm, and Alfred Harvey, the assistant, were called, who both deposed that the chain was not sold as a gold chain, but as described in the invoice, simply as a chain.

His Worship said this case was clearly defended in order that it might be ascertained whether there was any way out of the case of "Young *v.* Cooke," but not having had an opportunity of reading that case, he would adjourn his decision for four weeks.

SOCIETY OF ARTS' SILVER MEDAL AND £10 BLOWPIPE APPARATUS.

IN our number of last June we gave particulars of the conditions on which this prize was based, and from the Journal of the Society for March 2nd we learn that the competition was a smart one. The following committee was appointed to consider the award of the prize: Major-General F. C. Cotton, C.S.I. (Chairman of the Council), Mr. F. A. Able, C.B., F.R.S., Dr. C. Le Neve Foster, Captain Douglas Gatton, C.B., F.R.S., Admiral Sir Erasmus Ommanney, C.B., F.R.S., Mr. E. C. Tufnell and Mr. Warrington Smyth, F.R.S. The apparatuses for competition were to be sent to the Society's house on or before August 1st, 1877, and it was stipulated that the successful party should guarantee to keep a proper supply of the apparatuses on hand for sale in England. The prize was competed for by English and Continental makers of scientific instruments, &c., and their several sets were all subjected to the most careful trials by Dr. C. Le Neve Foster, H.M. Inspector of Mines, and on his report the committee determined that though many of the sets showed a considerable advance over previous productions, they were not justified to award the prize offered. A fresh competition was therefore opened among those who had already sent in, and a letter was addressed to each, pointing out what the committee considered the deficiencies of his set, and inviting him to send his apparatus in again modified as suggested. The date of the new competition was fixed for Dec. 31st.

The greater part of the competitors again sent in, and after subjecting the apparatuses to fresh trials, the committee determined to recommend that the prize should be awarded to Mr. T. H. Letcher, of St. Day, and Mr. John T. Letcher, of Camborne, Cornwall. The report of the committee was received and adopted by the Council at a subsequent meeting. In recommending the box to all users of the blowpipe, we would remark that it contains an entirely new form of blowpipe which will commend itself at a glance, and the fact of the whole of the apparatus being sanctioned by the Society of Arts is of itself a guarantee of its superiority.

MESSRS. W. POTTER AND SONS' EXCELSIOR STEAM WORKS.

IN our notice of the above establishment in our last issue, we inadvertently substituted their previous address for the present one. The Excelsior Steam Works are at 109 and 110, Aldersgate Street, near Aldersgate Street Station, and not at 136 and 137, as erroneously stated.

Pneumatic clocks are becoming a fashion in Paris and in Vienna. Air is compressed into and preserved in a central reservoir. From this pipes are carried and laid down to any number of houses and attached to the clocks; the pendulum releases uniformly the same measure of air which moves the clock-work, so that time is "laid on" just as are water and gas.

The members of the Geneva Society of Arts, Horological Section, have resolved to hold an exhibition of tools, for watchmakers, jewellers, musical box makers, and the various other trades connected therewith. It is to be opened shortly after the close of the Paris International.

Silvering Ivory.—Immerse a small slip of ivory in a weak solution of nitrate of silver, and let it remain till the solution has given it a deep yellow colour; then take it out, and immerse it in a tumbler of clear water, and expose it to the rays of the sun. In about three hours the ivory acquires a black colour; but the black surface on being rubbed soon becomes changed to a brilliant silver.

THE

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Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at MILNERS' BUILDINGS, MOORGATE STREET (OPPOSITE MOORGATE STREET STATION), LONDON, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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Cheques and Post-office Orders to be made payable to A. VICTOR, at Lombard Street Post Office.

PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

792. GEORGE MANTLE, of Birmingham, in the county of Warwick, jeweller, for an invention of "A new or improved fastening for lockets."—Dated 26th February, 1878.

904. SAMUEL HICKLING PARKES, of Birmingham, in the county of Warwick, manufacturer, for an invention of "Improvements in microscopes."—Dated 6th March, 1878.

999. WILLIAM HENRY PEAKE, of Gerrard-street, Soho, in the county of Middlesex, jeweller, for an invention of "Improvements in bracelets or armlets."—Dated 13th March, 1878.

1001. WILLIAM FRANCIS REYNOLDS, of 547, Commercial Road East, in the county of Middlesex, nautical instrument maker, for an invention of "Improvements in ships' compasses, and in apparatus for finding the deviations thereof."—Dated 13th March, 1878.

1003. FREDERIC MANTLE, of Birmingham, in the county of Warwick, jeweller, for an invention of "Improvements in snaps or fastenings for neck-chains, necklaces, neck ribbons or bands, bracelets, and other like articles."—Dated 13th March, 1878.

1150. LOUIS PREAUBERT, of Nantes (Loire Inferieur), France, Ornamental Painter, for an invention of "An improved process of bronzing, gilding, and silvering all surfaces in general."—Dated 22nd March, 1878.

Notices to Proceed.

4023. FRANK WIRTH, of the firm of Wirth and Company, patent solicitors, at Frankfort-on-the Maine, in the empire of Germany, has given notice in respect of the invention of "An improved remontoir for mantel clocks."—A communication to him from George Crespel, a person resident at Frankfort-on-the-Maine, in the empire of Germany.

4133. JOHN MATTHIAS AUGUSTUS STROH, of Hampstead Road, in the county of Middlesex, has given notice in respect of the invention of "Improvements in means or apparatus for regulating the speed of clock-work for telegraphic and other purposes."

4244. CHARLES EMILE REYNAUD, of Paris, in the French republic, has given notice in respect of the invention of "An improved apparatus for the production of optical illusions, called the 'Praxinoscope.'"

4904. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, patent agent, has given notice in respect of the invention of "An improved universal time-piece or geographical clock."—A communication to him from abroad by William Asro Cates, of Union, in the county of Union and State of Oregon, U.S.A.

726. WILLIAM BROOKS, of 62, Chancery Lane, in the county of Middlesex, patent and registration agent, has given notice in respect of the invention of "Improvements in parts of watches and such like time-keepers."—A communication to him from abroad by Frederic Fitt, of Ottawa, in the province of Ontario, in the dominion of Canada.

Patents which have become void.

677. WILLIAM MCINTYRE CRANSTON, of 36, Worship-street, Finsbury, in the county of Middlesex, for an invention of "Improvements in portable lathes chiefly intended for the use of dentists and jewellers."—A communication to him from abroad by Franklin Scott, of Bennington, State of Vermont, in the United States of America.—Dated 24th February, 1875.

764. JOHN CHESHIRE, of Birmingham, in the county of Warwick, corkscrew manufacturer, for an invention of "Improvements in solitaires, sleeve links, and other like dress fastenings and ornaments."—Dated 2nd March, 1875.

Patents Sealed.

80. WILLIAM MORGAN-BROWN, of the firm of Brandon and Morgan-Brown, engineers and patent agents, of 38, Southampton Buildings, London, and 1, Rue Laffitte, Paris, for an invention of "Improvements in regulator clocks, in the mechanism for transmitting time from the same to distant indicating dials, and in the receiving mechanism imparting motion to the hands of such dials."—A communication to him from abroad by Edward James Muybridge, of San Francisco, United States of America.—Dated 5th January, 1878.

3407. DESIRE L'HEUREUX and HIPPOLYTE LIGNY, both of Copenhagen-street, in the county of Middlesex, and PERCY COCKER, of Hampstead Road, in the same county, for an invention of "Improvements in engraving, both sunk and in relief, on metal, stone, and other hard surfaces."—Dated 7th September, 1877.

3444. AUGUSTE LION, jeweller, of the city of Paris, in the republic of France, for an invention of "Improvements in the manufacture of bracelets."—Dated 12th September, 1877.

4281. WILLIAM HAIR HASELER, of Birmingham, in the county of Warwick, goldsmith and jeweller, for an invention of "Improvements in magnetic or mariners' compasses and in ornamenting the said compasses."—Dated 15th November, 1877.

3627. GEORGE WILLIAM AMBRIDGE, of 2, Myrtle-street, Hoxton, London, N., philosophical instrument maker, for an invention of "An improved kaleidoscope."—Dated 27th September, 1877.

Designs Registered.

6011. JOHN DODWELL BADDELEY, of 84, Gcach-street, Birmingham, for "Improved fastening for eardrops and other articles of jewellery."—Dated 9th March, 1878.

6015. F. R. BAKER, of Buckingham-street, Birmingham, for "A scarf ring."—Dated 20th March, 1878.

Grants of Provisional Protection for six months.

603. To ALFRED VINCENT NEWTON, of the Office for Patents, 66, Chancery Lane, in the country of Middlesex, mechanical draughtsman, for the invention of "An improvement in object glasses for microscopes."—A communication to him from abroad by Ernst Gundlach and John Jacob Bausch, of Rochester, in the State of New York, and Henry Lomb, of Brooklyn, in the tate of New York, United of America.

705. To MARTIN KOSMINSKI, of Aldermanbury, in the city of London, furrier, for the invention of "An improved apparatus for use in effecting the winding-up of watches, clocks, and other mechanism requiring similar winding-up."

648. To ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the country of Middlesex, patent agent, for the invention of "Improvements in object glasses for astronomical telescopes and other optical instruments."—A communication to him from abroad by Ernst Gundlach and John Jacop Bausch, both of Rochester, and Henry Lomb, of Brooklyn, both in the State of New York, United States of America.

726. To WILLIAM BROOKES, of 62, Chancery Lane, in the county of Middlesex, patent and registration agent, for the invention of "Improvements in parts of watches and such like time-keepers."—A communication to him from abroad by Frederic Fitt, of Ottawa, in the provice of Ontario, in the dominion of Canada.

792. To GEORGE MANTLE, of Birmingham, in the county of Warwick, jeweller, for the invention of "A new or improved fastening for lockets."

904. To SAMUEL HICKLING PARKES, of Birmingham, in the county of Warwick, manufacturer, for the invention of "Improvements in microscopes."

953. To JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, in the county of Middlesex, gentleman, for the invention of "Improvements in electro-magnetic machines."—A communication to him from abroad by Zuobe Théophile Gramme and Eardley Louis Charles d'Ivernois, both of Paris, in the republic of France.

Patents Granted in Foreign States.

GERMAN EMPIRE.

2745. C. WINKLER, of Hanau, for "Obtaining swivel-lockets with revolving eyes without joints and soldering."—Dated 2nd February 1878.

2788. L. Jehlin, of Sackingen, for "A rotary pendulum."—Dated 2nd February, 1878.

564. P. Ehrlich, of Gohlis, for "A contrivance for musical boxes."—Dated 3rd July, 1877.—Class 51.

585. C. Domon, of Bienne, Switzerland, for "A remontoir (keyless) watch."—Dated 28th July, 1877.—Class 83.

598. E. Lentz, of Dantzig, for "Studs for cuffs and chemisettes."—Dated 10th August, 1877.—Class 44.

601. R. Speltz, of Frankfort-on-Maine, for "Fastenings for ear-rings."—Dated 14th August, 1877.—Class 44.

626. F. Denckmann, of Hamburg, for "A stud for cuffs."—Dated 19th September, 1877.—Class 44.

665. A. Bothe, of Charlottenburg, for "A watch-guard."—Dated 16th August, 1877.—Class 44.

666. C. Muuss, of Lubeck, for "Studs for cuffs."—Dated 19th August, 1877.—Class 44.

670. N. Salmon and Delaviere, of Paris, for "Studs for cuffs and shirts."—Dated 26th August, 1877.—Class 44.

767. G. F. Thode, of Dresden, for "Improvements in collar studs."—Dated 2nd September, 1877.—Class 44.

773. C. A. Mayrhofer, of Vienna, for "A second-watch with anchor-escapement and hydro-pneumatic motion."—Dated 6th September, 1877.—Class 83.

809. W. Motz, of Berlin, for "Separable studs."—Dated 9th, October, 1877.—Class 44.

822. C. Bescherer, of Zeitz, for "A finishing engine for watch-makers."—Dated 4th July, 1877.—Class 83.

850. A. Koch and F. Schaack, of Cologne, for "An electro-magnetic normal clock."—Dated 12th September, 1877.—Class 83.

Austria.

27. W. H. Douglas, of Stourbridge, for "Improvements in studs or clasps."—Dated 27th September, 1877.—(English Patent, 15th September, 1876.)

56. C. Krauss, of Vienna, for "A watch with an electro-magnetic remontoir."—Dated 11th September, 1877.

Belgium.

44,110. A. Dardenne, of Mariembourg-Couvin, for "Working clocks by means of atmospheric air."—Dated 28th January, 1878.

44,114. Hubert and Co., a Patent of Improvement for "A Bracelet."—Dated 28th January, 1878.—(Original Patent, 24th December, 1877.)

44,124. W. H. Kerr, for an imported Invention of "Preparing substances for the manufacture of telegraphic insulators."—Dated 28th January, 1878.—(English Patent, 30th June, 1877.)

44,146. L. Clemandot, of Brussels, a Patent of Improvement for "Applying nickel as a preventive of oxidation."—Dated 30th January, 1878.—(Original Patent, 17th November, 1876.)

44,168. A. G. L. Barre, of Molenbeek, for "A disoxidating bath for cleaning fine machinery or clocks."—Dated 1st February, 1878.

44,193. Markowitsch and Scheid, for "A clasp for bracelets."—Dated 5th February, 1878.

44,299. C. Riballier, for "Decolouring tinctured diamonds."—Dated 16th February, 1878.—(French Patent, 13th November, 1877.)

44,429. G. Crespel, for "A remontoir for clocks."—Dated 1st March, 1878.

Canada.

8178. Zephaniah Phillips, of Bridgeport, Ohio, U.S., for "Improvements in time locks." (Perfectionnements aux serrures à méchanisme d'horlogerie.)—5 years.—Dated 6th December, 1877.

8249. Cecile Domon (assignee of Ovide Domon), of Bienne, Switzerland, for "Improvements of watches." (Perfectionnements aux montres.)—5 years.—Dated 26th December, 1877.

France.

119,970. Thibust, of Paris, for "Plâting and ornamenting metals."—Dated 20th August, 1877.

120,049. Jesson, for "A so-called mysterious clock."—Dated 1st September, 1877.

120,084. Muller, for "A compensation chronometer for mean and extreme temperatures, applicable to all sorts of clocks."—Dated 29th August, 1877.

120,193. Ferrier, of Cousance, for "A clock with a horizontal pendulum."—Dated 10th September, 1877.

120,213. Boillot, of Besancon, for "A motion for remontoir watches timed by the pendant."—Dated 11th September, 1877.

120,219. Ley, for "Improvements in clocks."—Dated 6th September, 1877.

120,255. Pilet, of Besancon, for "Tools for manufacturing and decorating watch-cases."—Dated 6th September, 1877.

120,266. Pellerin, of Paris, for "A comical trinket applicable to breast-pins, studs, &c."—Dated 11th September, 1877.

120,405. Cibert, of Tours, for "A universal remontoir for watches."—Dated 27th September, 1877.

120,435. Bescherer, for "A universal machine for cutting the wheels of clocks and watches."—Dated 21st September, 1877.

120,467. Legrand, for "A so-called 'châtelaine remontoir.'"—Dated 25th September, 1877.

120,463. Labbe, for "Studs for cuffs."—Dated 24th September, 1877.

120,549. Husson, of Paris, for "Bracelets, rings, &c., convertible into a spherical shape."—Dated 2nd October, 1877.

120,588. Rouquier, for "A machine for manufacturing metal stars employed in jewellery."—Dated 25th August, 1877.

120,686. Flechet, for "A universal solar chronometer."—Dated 11th October, 1877.

120,715. Bourdelot, for "Mounting the jewellery called 'pavé' with gold instead of silver."—Dated 21st September, 1877.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Adams, Joseph, Mount-street, Coventry, watch manufacturer. Feb. 25. H. J. Davis, solicitor, Coventry.

Cockshott, Henry Crossley Mayo, Francis-street, Ashted, Birmingham, goldbeater. Feb. 23. A. B. East, solicitor, Birmingham.

Dyson, John Joseph, 59b, Girlington-road, Bradford, jeweller. Feb. 26. W. Spencer, solicitor, Bradford.

Maguire, Wilb. 75, Great Hampton-street, Birmingham, jewellery manufacturer. Feb. 19. Johnson, Barclay, & Johnson, solicitors, 36, Waterloo-street, Birmingham.

Weinrabe, Abraham Maurice, 28, Turner-street, Commercial-road, jeweller. Feb. 25. W. E. Goatley, solicitor, 5, Bow-street, Covent Garden.

Wesley, Wm. Parkinson, Arcade, Fishergate, Preston, jeweller. Feb. 26, F. Edelston, solicitor, Preston.

Wilkinson, Benj., Congreve-street, Birmingham, watchmaker. Mar. 2, J. Boraston, solicitor, 55, Ann-street, Birmingham.

Grindrod, Isaac, Church-street, Blackpool, watchmaker. Mar. 6. E Dean, solicitor, Blackpool.

Hawkins, Edwards, Bernard-street, Bloomsbury, late Coventry, watch manufacturer. March 8. G. Lockyer, solicitor, 1, Gresham-buildings.

Jeffreys, John Compton, trading as John Jeffreys & Co., 1, Tudor-place, and 14, Tottenham-court-road, fancy jewellery merchant. March 5. Beyfus & Beyfus, solicitors, 69, Lincoln's-inn-fields.

Stickley, Jas., 194, High Holborn, late Cross-street, Hatton Garden. gold beater. March 4. W. A. Greatorex, solicitor, 59, Chancery-lane.

Behmber, Augustus, 7, Chippenham-terrace, Harrow-road, watch maker. March 6. J. Rae, solicitor, 9, Mincing-lane.

Birdsall, Jacob, and Saml. Birdsall, trading as Birdsall & Son, Bradford, jewellers. March 14. Watson & Dickson, solicitors, Bradford.

Trowbridge, Edwd., High-street, Staines, jeweller. March 14. Reece & Harris, solicitors, 47, New-street, Birmingham.

Ward, Abraham, trading as A. Ward & Sons, 72, Unett-street, Birmingham, goldsmith and jeweller. March 13. Wright & Marshall, solicitors, New-street, Birmingham.

Zielinsky, Adam, Commercial-street, Whitechapel, jeweller. March 8. Kisch, Son, & Hanbury, solicitors, 3, Chancery-lane.

Ainsworth, Henry, South-street, Romford, watchmaker. March 19. Clifton & Haynes, solicitors, Romford.

Wattleworth, Robinson, Whitehaven, watchmaker. March 18. J. Mason, solicitor, Whitehaven.

Trustees Appointed.

Asher, Jacob (Liq.), Stock's-street, Cheetham, jeweller. Tr., T. Barge, 38, Victoria-street, Manchester, accountant.

Cooper, Richard (Liq.) Great Ancoats-street, Manchester, jeweller. Tr., S. B. Kendal, 56, Peter-street, Manchester, accountant.

Smith, Meyer (Liq.), Newport-road, Middlesborough, jeweller. Tr., J. H. Gibson, Middlesborough, accountant.

Wallani, Edwd. (Liq.), Alfred-place, Bedford-square, manufacturing jeweller. Tr., A. Dumert, 57, George-street, Euston-road, and C. Deureaux, 39, Hatton-garden, both dealers in precious stones.

Hartshorn, William (Liq.), King's-square, Clerkenwell, watch manufacturer. Tr., R. Walker, 125, Central-street, City-road, watch and case gilder.

Campbell, Thomas, trading as John Campbell (Liq.), South Castle-street, Liverpool, jeweller. Tr., H. Bolland, Liverpool, accountant.

Sequestrations in Scotland.

Stbeamer, Marcus, 141, George-street, Glasgow, watch manufacturer and wholesale jeweller. March 25, with protection. Tr. & Com., Faculty Hall, Glasgow, April 5 at 12. Claims by July 25. Agents, D. & J. Hill, 73, Renfield-street, Glasgow.

Waldie, Pius, Beauly, watch and clock maker. March 21. Tr. & Com., Procurator's Rooms, Castle, Inverness, March 30 at 1. Claims by July 21. Agent, J. Colvin, Inverness, solicitor.

Dissolution of Partnerships.

Bryant, W. & J., trading as **Wm. Bryant**, Myrtle-street, Liverpool, watchwakers. March 1. Debts by William Bryant.

Distribution of Assets.

Tapley, Thomas H., Henley-on-Thames, late 137, Sandringham-road, London, jeweller, died July 10. Claims by April 20 to Letts Bros., 8, Bartlett's-buildings, Holborn-circus, solicitors.

Adjudications of Bankruptcies.

Rowson, Henry, 18, Exchange-street East, Liverpool, jeweller and watchmaker. March 18.

THE LONDON DIAMOND CLUB.

On Thursday evening, the 21st ult., the members of the above club entertained Mr. F. Cook at a dinner given at the Grays Inn Tavern, 13, High Holborn. Among those present were A. Auerhaan, Esq., president of the club, in the chair, S. Goldman, Esq., vice-president, M. Davis, Esq., hon. sec., Messrs. H. Albert, A. Moore, B. Bookbinder, H. Sessell, E. Cooper, H. M. Levy, G. Robinson, J. Raphael, and several other members of the club anxious to testify by their presence the high regard and esteem in which Mr. Cook is held by the trade in general.

The dinner was provided by Mr. R. George, and was served in a very creditable and superior manner, nothing being left wanting which could possibly add to the comfort of the guests.

After the cloth had been removed and the usual loyal toasts given, the health of Mr. Cook was proposed and duly responded to by that gentleman. Several other toasts were likewise given and duly responded to, and the company separated at a late hour, having spent a very enjoyable evening. Altogether the entertainment reflected great credit on all those concerned.

Alluding to the Diamond Club itself, we may remark that it has now been established about six months, and is in a very flourishing and prosperous condition, numbering among its members most of the leading and prominent persons in the trade. Under its present management it is likely to increase in prosperity, and we predict that the day is not far distant when the club will own its own premises and rank among the leading ones of the metropolis.

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Illustrirte Fachzeitschrift fur Uhrmacher.
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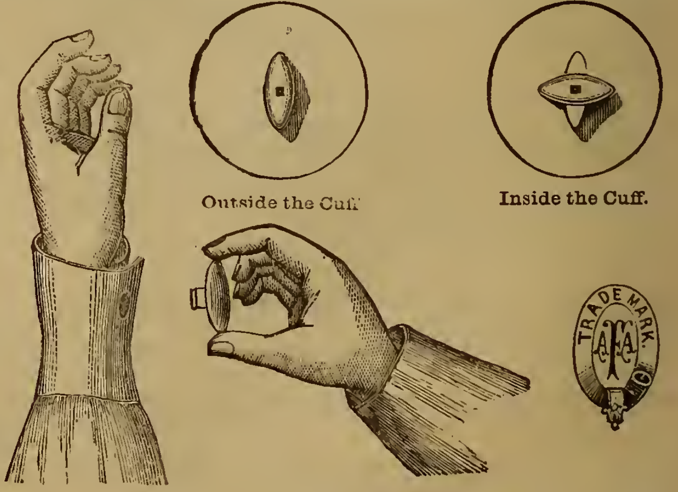
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JOURNAL.
W.H. TILBY

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Entered at Stationers' Hall.—Registered for Transmission Abroad.

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HOROLOGY.

(*Continued from page* 195.)

XXXIII.—Its Relations to Astronomy.

By G. B. Miller.

It has been before stated that Kepler demonstrated a grand law of motion among the planets, "that the squares of the times of all the planets are proportional to the cubes of the distances." The Jovial system offered a fine object by which to ascertain whether the same law held good as to the planet and its satellites, as well as to the sun and his attendants. If, in the demonstration, it was found to be the case with Jupiter and his moons, there could no longer be a doubt of the law being general, whether applied to the primary and satellites, or the secondary and its moons. Severe tests have proved the law of Kepler correct, not only of this system, but subsequent observations have shown its extended influence into space. To demonstrate this law was not the only purpose to be subserved in studying the Jovial system; its great importance in obtaining terrestrial longitude was of still greater value to the practical wants and occupations of mankind.

The determination of longitude by the positions of Jupiter's moons is, however, subject to too much uncertainty for ordinary purposes, either on land or sea, the length of the intervals and the great distances offering alike obstacles to accuracy. Still, it is indispensably necessary to find some means of determining longitude (time), on which not only the geographer can rely for his station longitude, but on "which the navigator can securely stake, at every instant of his adventurous course, the lives of himself and comrades, the interest of his country, and the fortunes of his employers." This means of ascertaining the longitude is afforded by lunar observations. The moon, being the nearest and most conspicuous body visible from the earth, has always been the most closely observed of all the celestial objects. Several circumstances concur to render her motions the most interesting, and, at the same time, the most difficult to investigate. In the lunar theory more importance is attached for the reason that lunar distances are the very best data for longitude, and therefore for time. It was long before the apparently erratic movements of the moon were fully comprehended or tabulated; the ordinary disturbances that occur between planet and planet hardly express the relations of the moon to the earth, for the sun, notwithstanding his immense distance, has a compensating influence by reason of his enormous mass. The moon, then, is influenced, not only by the sun, but the earth being nearest, and the law of action and reaction being good, the earth has by proximity a stronger hold than the sun, but not strong enough to prevent disturbances in the ordinary motions of the moon, arising from the attractive influence of the sun.

Owing to these two disturbing causes, the motions of the moon are more irregular than any of the planets, and yet have been reduced to as precise a demonstration as any problem in astronomy. The fact that the position of the moon, at any moment, can be ascertained in relation to the stars in their positions at any time, is a point from which longitude can be ascertained with a degree of precision that is unattainable by any other means, save a good transit. We give a table of the moon, as it will be necessary to refer constantly to the facts.

SYNOPTIC TABLE OF THE MOON.

Mean distance from the earth	237769,44 miles.
	d.
„ Sidereal evolution	27.322
„ Synodical „	29,531
Eccentricity of orbit	,05
	d.
Mean revolution of nodes	6793,391
„ „ Apogee	3232,575
„ Longitude of node at epoch	13° 53′ 17″ 7
„ „ Perigee	266 10 75
„ Inclination of orbit	5 8 39 96
„ Longitude of moon at epoch	118 17 8 3
Mass, the earth being 1	0,011346
Diameter in miles	2164.5
Density, the earth being 1	0.55654

Again, as has already been stated in the course of these articles, the path of the moon's orbit is influenced, not only by the earth itself, but by its form and constitution. Thus, the protuberance of the earth at its equatorial diameter determines various changes in the moon's motion, and the same result obtains, by reason of the increased specific gravity of the earth towards its centre. These would so naturally interfere with the direction of the path of the moon in her orbit as to draw the attention of even the earliest observers.

The earth, however, does not move always in the same line of orbit, for, though the major axis must remain the same, the minor axis of the ellipse may be changed, and as for ages the minor axis has been shortened, the combined influence of the earth and sun has, in strict accordance with theory, increased the motion of the moon in her orbit. The theory of the acceleration is founded on the following considerations and facts:—For ages past the ellipticity of the earth's orbit has been decreasing, and it can be proved that the greater the eccentricity of the orbit the greater is the disturbing action of the sun. In the whole solar system, as we have before stated, planets disturb other planets; but in our calculations of the lunar motions we are compelled to assume the sun, by reason of his mass and proximity, to be the great source of all the lunar perturbations, and thus it follows that on a decrease of the eccentricity the earth would have more influence over the moon's motion. Now, as the eccentricity of the terrestrial orbit has been diminishing for hundreds of centuries, the earth's attraction for the moon has exerted a force stronger than that of the sun's proportionally, and the velocity of the moon in her orbit has, in consequence, been on the increase. This change in velocity was noticed in very early ages, and as the same course continues to exist, this increased motion, called acceleration, will be extended to future ages, until the eccentricity of the earth's orbit ceases to diminish, or, in other words, comes to its minimum, after which the moon will be retarded in her orbit from age to age.

The secular acceleration is now about 11″.9; but its effect on the moon's place increases as the square of the time. The secular diminution in the eccentricity of the earth's orbit has not altered the equation of the centre of the sun by eight minutes since the earliest recorded eclipses, but it has produced a variation of about 1° 50′ in the moon's longitude, and of 7° 12′ in his mean anomaly, which is its angular distance from the perihelion, supposing the moon to move in a true circle. The true anomaly is the angular distance from the perihelion in its elliptical orbit. The disturbing action of the sun on the moon is equivalent to three forces; and the distinction must be borne in mind, if the reader wishes to get a comprehensive idea of the lunar motions.

The first force acts in the direct line joining the sun, moon, and earth, and diminishes the attractive force of the earth for the moon. To explain the second will involve some little consideration in positions—relative, of course. By looking at the table the reader will see that the mean inclination of the moon's orbit to the plane of the ecliptic is 5° 8′ 39″. 96. Now, depending on the earth's place in her orbit, the moon will present to the sun an object to be drawn perpendicularly from its orbit. The other direction of force is purely tangential, tending to alter the motions in longitude, while the action of the sun on the plane of the orbit disturbs her latitude; in other words, tends to bring the plane of the orbit nearer or farther off the ecliptic.

The perturbations thus caused by the combined action of the sun and earth are precisely similar to those occurring among the planets, and the best demonstrations of the effects of gravitation was afforded in the celebrated problem of the three bodies—the sun, moon, and earth. When the line between the three bodies is straight, the superior attraction of the sun tends to diminish the eccentricity of the moon's orbit in conjunction and opposition, thus making it at those times more circular, while the very same cause at the quadrature tends to make the orbit more elliptical. This well-known inequality is called evection. The whole period of this perturbation is less than thirty-two days. Now, even in this "equal inequality" there are some considerations that, in the construction of lunar tables, have to be taken into account. Thus, were the increase and diminution always the same, the evection would depend only on the distance from the sun; but the value of the variation will, in a great measure, be determined by her (the moon's) distance from the perigee of her orbit.

This evection was detected by Ptolemy, in A.D. 140; but all the ancient astronomers assigned to the orbit of the moon too great an ellipticity. It must be remembered that the chief aim in the observations of the moon at that time was purely in regard to the prediction of eclipses; and as these can only happen when the satellite is in conjunction or opposition, the eccentricity would be materially diminished at the time of observation. We have often stated that a body revolving around a common centre, influenced by the two forces (tangential and gravitating), would describe an ellipse; the degree of eccentricity being determined by the distance of the centre of attraction, and the original impulse given to the body. This last is called tangential force. As an ellipse has two diameters, we, as in the demonstration of the revolution of the major axis of the earth's orbit, would expect the orbit of the moon to be more elliptical, and attended by more disturbances than in the case of a planet.

If the orbit of the moon is an ellipse, it is evident that there must be two points in the orbit that are nearest the earth. We may infer, then, that the line of the two nearest points must follow the same general law of the revolution of the major axis. This motion of the minor axis is called the motion of the apsides, and it may be very beautifully illustrated by a very simple mechanical contrivance, that shows very finely the mode in which orbitual motion is carried on under the action of central forces, according to the situation of the revolving body. Fourcault, in France, has demonstrated the revolution of the earth, by means of a pendulum vibrating in the same place. Now, by means of a rotary pendulum we are able to prove to the most uneducated mind that an ellipse must be the result of the rotation. It must be understood that the most perfect freedom of the planetary bodies cannot be obtained with the apparatus we are about to describe.

Let a leaden weight be suspended, by means of an annealed iron or brass wire, in such a manner that the point of support is firm, and the weight free to revolve in what should apparently be a circle around the point of suspension. We will suppose the apparatus well put up. Now, if attempting to give it a circular motion we will find that if the pendulum receives a slight motion, and if the weight be heavy, by placing a paper beneath it and affixing a pencil to the bob, that the path the pencil traces will be an ellipse, which has for its centre the point of suspension. The major and minor axis of this ellipse will change but little during a long time, though the friction of the air and rigidity of the suspension wire may diminish the dimensions and eccentricity. Suppose, however, that we incline the weight from the vertical to an extent of 15° or 20°, we shall find that the former continued direction of the major and minor axes no longer subsists. Both will be seen to shift their position with every successive revolution, and always the advance will be in the direction of the pendulum's rotation. This advance will be found to be in an uniform and regular progression, and after a time the two axes will have entirely reversed their relations, thus giving a good visual idea of the moon's motion and also the changes that take place in the position of the apsides. Another form of this mechanical illustration may be introduced by substituting, in place of a weight simply, a hollow space attached to the weight with a very small orifice, being filled with very fine dry sand; it will be found that the scatterings of the sand on any surface directly beneath the revolving pendulum will describe an ellipse, and if the same amount of force is applied the revolution of the apsides will be found to be demonstrable physically. This illustration of a mental structure, if we may so speak, by purely mechanical means, shows the simplicity with which great astronomical truths can be exhibited, open to the comprehension of those who are totally unaccustomed to the method of mathematical reasoning or astronomical research. We should not have dwelt so much on these perturbations had we not considered that a knowledge of the lunar tables and calculations was an important part of the study of horology.

The method of obtaining time by lunar observations, as well as its accuracy, will naturally depend on a certain knowledge of the moon's place at any given moment, and at any point of observation on the earth's surface. Thus, we may suppose a star to be east or west of the moon; if her place has been tabulated, we may take from the Ephemeris her place and the relation she should bear to the observer at Greenwich, at any designated time, to any star that may be in the catalogue. It will be apparent that those stars nearly in the same circle of declination as the moon will be the best objects of observation. Obviously, one person alone could not determine the position of the moon's semi-diameter and another object at one and the same moment; therefore, it requires two observers to take simultaneous observations, and yet a third to note the instant of the local time at which the observations were taken. This renders the system impracticable for the watchmaker, who wishes a simple and easy method of correcting his clock-rate. There is no other mode of ascertaining longitude at sea that offers so many advantages and so great accuracy as that of lunar distances, from the simple reason that no other source is known in astronomy by which accurate time can be taken where the instrument is not permanently fixed.

It is obvious that the motion of the ship prevents the use of any instrument for observation that is confined strictly to the meridian; and again, the change of locality, even were it possible to hold the instrument steady, would imply the obtaining a new meridian for every observation. But on land, where the location is fixed, there can be no better means of ascertaining the correct time than by the transit instrument. Its very name implies its use, for it is intended to note the passage of any celestial body over the local meridian. The fact, then, is apparent that the line of collimation should be exactly in the meridian; and at whatever angle it may be set in the vertical arc, the true line should be maintained.

(To be continued.)

CHRONOMETER TRIALS AT HAMBURG.

GERMANY having become aware of the beneficial stimulus which chronometrical art receives from our annual trials at Greenwich, has instituted similar tests at the Hamburg Observatory, and has also adopted our system of treatment. We have now the report of the first competition before us, and we must confess that the results are very satisfactory. Thirty-four chronometers, the productions of nine German and three Swiss manufacturers, were entered for these trials. Seven of these chronometers have proved themselves to be high-class productions, and to give our readers a ready estimate of their time-keeping quality we compare their rates to those of the seven best English chronometers of last year's Greenwich trials.

GREENWICH.

Name of Maker.	No. of Chronometer.	Difference between the greatest and the least weekly sum.	Greatest difference between one week and the next.
Isaac	1,612	9·0 sec.	3·5 sec.
Edward and Sons	2,138	12·4 ,,	4·5 ,,
Keys	399	11·8 ,,	5·0 ,,
McGregor and Co.	5,003	14·1 ,,	5·0 ,,
Isaac	3,130	10·3 ,,	8·5 ,,
Graham and Parker	3,527	12·6 ,,	8·1 ,,
Pyott	458	15·9 ,,	7·2 ,,

HAMBURG.

Name of Maker.	No. of Chronometer.	Difference between the greatest and the least weekly sum.	Greatest difference between one week and the next.
Bröcking	824	5·9 sec.	3·4 sec.
Brocking	830	12·9 ,,	4·5 ,,
Brocking	779	10·5 ,,	5·9 ,,
Ehrlich	228	11·3 ,,	5·6 ,,
Kutter	19	10·8 ,,	6·5 ,,
Kutter	20	12·3 ,,	5·9 ,,
Nieberg	573	10·9 ,,	6·7 ,,

Chronometers nos. 824, 228, 19, and 573, were bought by the German Admiralty at the uniform price of £45 each.

WORKING WATCHMAKERS AT THE EXHIBITION.

THE city of Besançon, with a view of fully displaying its resources as a watch-manufacturing centre, has voted a sum of money for the establishment of a workshop within the Exhibition buildings. The atelier will contain all the most interesting appliances used in the trade, and some ten workmen will be busy under the eyes of the public for a few hours daily. The exhibitors of the above-named city have also appointed a representative capable of assisting visitors in their examination of the exhibits in this section.

COLOURING FOURTEEN CARAT GOLD.—Four parts saltpetre, two parts salt, three parts muriatic acid. Put the first two in pot and heat strongly, add a little water, let boil up, and when it becomes a thin paste add the muriatic acid, stir up and put in the work, taking care to submerge the work in the colour completely, let boil two minutes, add as much water as you did before muriatic acid, make it boil quickly again for two minutes, take out the work, boil in hot water, then in another pot of hot water, to which a few drops of muriatic acid is added, then rinse off in hot water, and dry off carefully in hot sawdust.

MANUFACTURE OF BRONZES.

IT is a most singular fact that melted gold, silver, copper, and iron, if poured hot into a mould, will take an impression of all the details of the pattern from which the mould was made only if the mould be made of sand. Zinc can be moulded in copper moulds, and that is the principal cause of the low price of spelter or zinc statuettes, known in the trade as imitation or French bronze. The real bronze is an alloy of copper, zinc, and tin, the two latter metals forming a very small part of the combination, the object of which is the production of a metal harder than the pure copper would be, and consequently more capable of standing the action of time, and also less brittle and soft than zinc alone would be. Let us follow a statuette through the different processes through which it has to pass from the time it leaves the hands of the artist who has modelled it, to that when it reaches the shop where it is to be sold.

The original statuette is generally finished in plaster. The manufacturer's first operation is to have it cut in such pieces as will best suit the moulder, the mounter, and the chaser; for very few statuettes are cast all in one piece. Arms and legs are generally put on after the body is finished. The next operation is to reproduce the different parts of the figure in metal. For this the moulder takes it in hand to prepare the mould. He begins by selecting a rectangular iron frame, technically termed a flask, large enough for the figure to lie in easily. To this frame, which is from two to six inches deep, another similar frame can be fastened by bolts and eyes arranged on the outside of it, so that several of these frames superposed form a sort of box. The workman places the plaster statuette, which is now his "pattern," on a bed of soft moulding sand inside the first iron frame. The sand used for mould-making is of a peculiar nature, its principal quality being due to the presence of magnesia. Only in one locality of the world is found the best sand—that is at Fontenay-aux-Roses, a few miles from Paris. This sand, when slightly damp, sticks together very easily, and is well fitted to take the impression of the pattern.

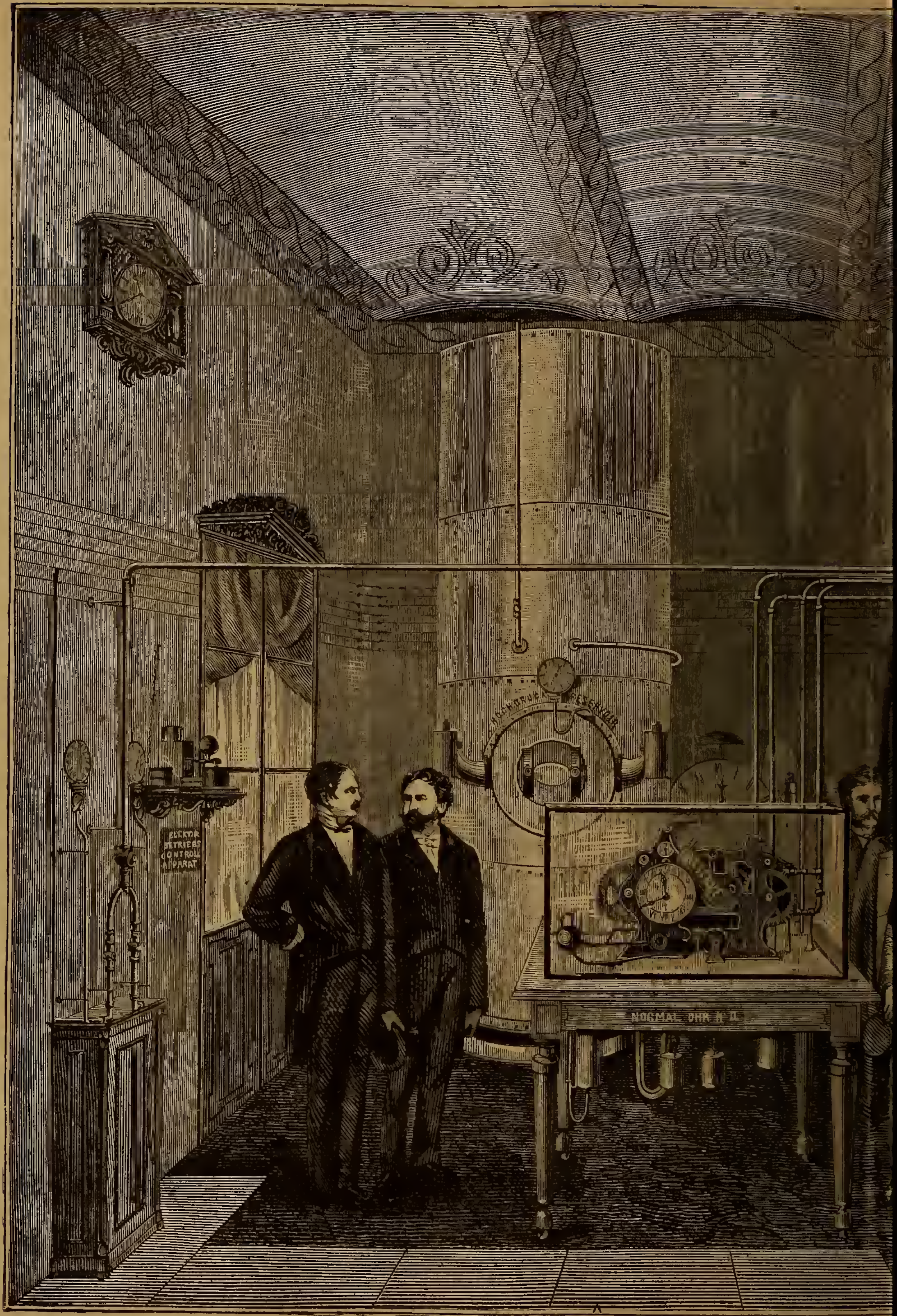
Once the pattern embedded in the sand, the workman takes a small lump of it, which he presses against the side of the figure, covering a certain portion of it. Next to this piece he presses another, using a small wooden mallet to ensure the perfect adhesion of the sand to the pattern. Each one of these pieces of sand is trimmed off, and a light layer of potato-flour dusted both over the pattern and the different parts of the mould, to prevent them from adhering together. In course of time the entire part of the pattern left above the first bed of sand on which it has been placed will be covered with these pieces of sand, which are beaten hard enough to keep together. Loose sand is now thrown over this elementary brickwork of sand, if it may be so called, and a second iron frame bolted to the first one to hold the sand together, which, when beaten down, will form a case holding the elementary sand pieces of the moulds in place. The workman now turns his mould over, and removes the loose sand which formed the original bed of the pattern, and replaces it by beaten pieces, just as he has done on the upper side.

We can now easily conceive that if the mould is opened the plaster pattern can be removed, and that if all the pieces of sand are replaced as they were, we shall have a hollow space inside the mould, which will be exactly the space previously occupied by the pattern. If we pour melted metal into this space, it will fill it exactly, and, consequently, when solidified by cooling, reproduce truly the plaster pattern. For small pieces this will answer very well; but large pieces must be hollow. If they were cast solid, the metal in cooling would contract, and the surface would present cracks and holes difficult to fill. To make a casting hollow, it is necessary to suspend inside the mould an inner mould, or "core," leaving between it and the inner surface of the first mould a regular space, which is that which will be filled by the metal when it is poured in. This core is made of sand, and suspended in the mould by cross wires or iron rods, according to the importance of the piece. A method often used in preparing a mould, named by the French *cire perdue*, will help to illustrate this. The artist first takes a rough clay image of the figure he wants to produce. This will be the core of the mould; he covers it with a coating of modelling-wax of equal thickness, and on this wax he finishes the modelling of his figure. The moulder now makes his sand-mould over the wax, and when it is completed by baking the mould in a suitable furnace, the wax runs out, leaving exactly the space to be filled up by the metal. The celebrated statue of Perseus, by Benvenuto Cellini, was cast in this way, and this method is very frequently employed by the Japanese and Chinese. Sometimes flowers, animals, or baskets are embedded in the mould, and after the baking, the ashes to which they have been reduced are either washed or blown out to make room for the metal. This can easily be done through the jets or passsges left for the metal to enter the mould, and through the vent-holes provided for the escape of air and gases.

When the mould has been cooled, it is broken to remove the casting it contains; and here is the reason why real bronze is so much more expensive than the spelter imitation. For each bronze a new sand-mould must be made, while the zinc or spelter can be poured into metal moulds, which will last a long time. In this way the pieces are produced with but little more labour than that required to manufacture lead-bullets. These pieces, of course, do not receive the same expensive finish as the real bronze. When the casting is taken out of the mould it goes to the mounter, who trims it off, fills the base "true," prepares the sockets which are to receive the arms or other pieces to be mounted, and then hands the piece to the chaser. The work of this artisan consists in removing from the surface of the metal such inequalities as the sand-mould may have left, and in finishing the surface of the metal as best suits the piece. The amount of work a skilful chaser can lay out on a piece is unlimited. In some cases the very texture of the skin is reproduced in the surface of the metal. This mode of chasing, called in French "*chairé*," and in English "skin-finish," is, of course, only found on work of the best class. Sometimes pieces are finished with slight cross-touches, similar to the cross-hatching of engraving; this style of finish, which is much esteemed by connoisseurs, is named "cross-rifled," or "*riboutê*." After the chaser has finished his work, the piece returns to the mounter, who definitively secures the elements of the piece in their places.

The next process is that of bronzing. The colour known as "bronze" is that which a piece of that metal would take through the natural process of atmospherical oxidisement, if it were exposed to a dry atmosphere at an even temperature. But the manufacturer, not being able to wait for the slow action of nature, calls chemistry to his aid, and by different processes produces on the surface of the piece a metallic oxide of copper, which, according to taste or fashion, varies from black to red, which are the two extreme colours of copper oxide. The discovery of old bronzes, buried for centuries in damp earth, and covered with verdigris, suggested the colour known as vert antique, which is easily produced on new metal by the action of acetic or sulphuric acid. In the fifteenth century the Florentine artisans produced a beautiful colour on their bronzes by smoking them over a fire of greasy rags and straw. This colour, which is very like that of mahogany, is still known as Florentine or smoked bronze. Bronze can also be plated with gold and silver, nickel and platinum, like every other metal.

WE hear that Messrs. Barraud & Lund, of Cornhill, London, have just shipped twenty-four station clocks and thirty-one railway watches for the Government of New South Wales.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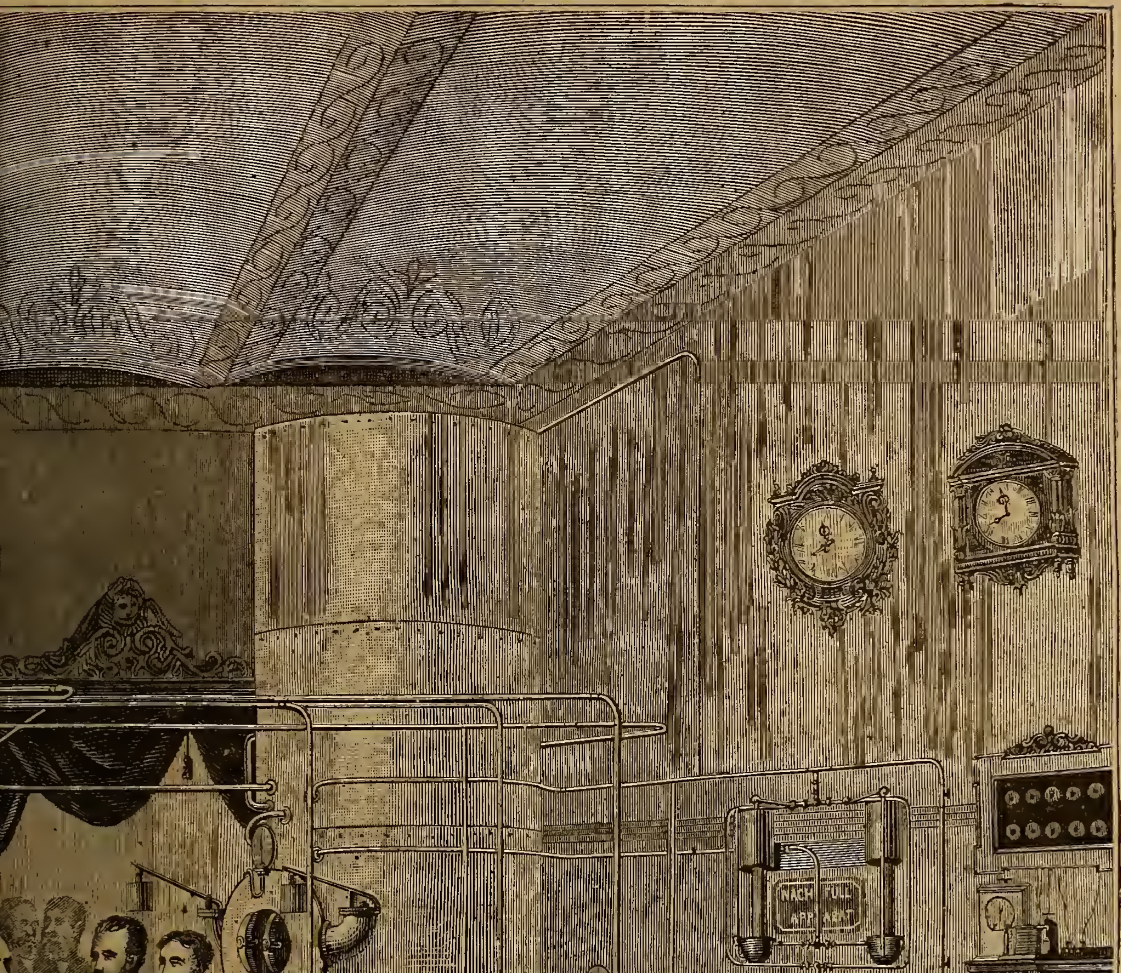
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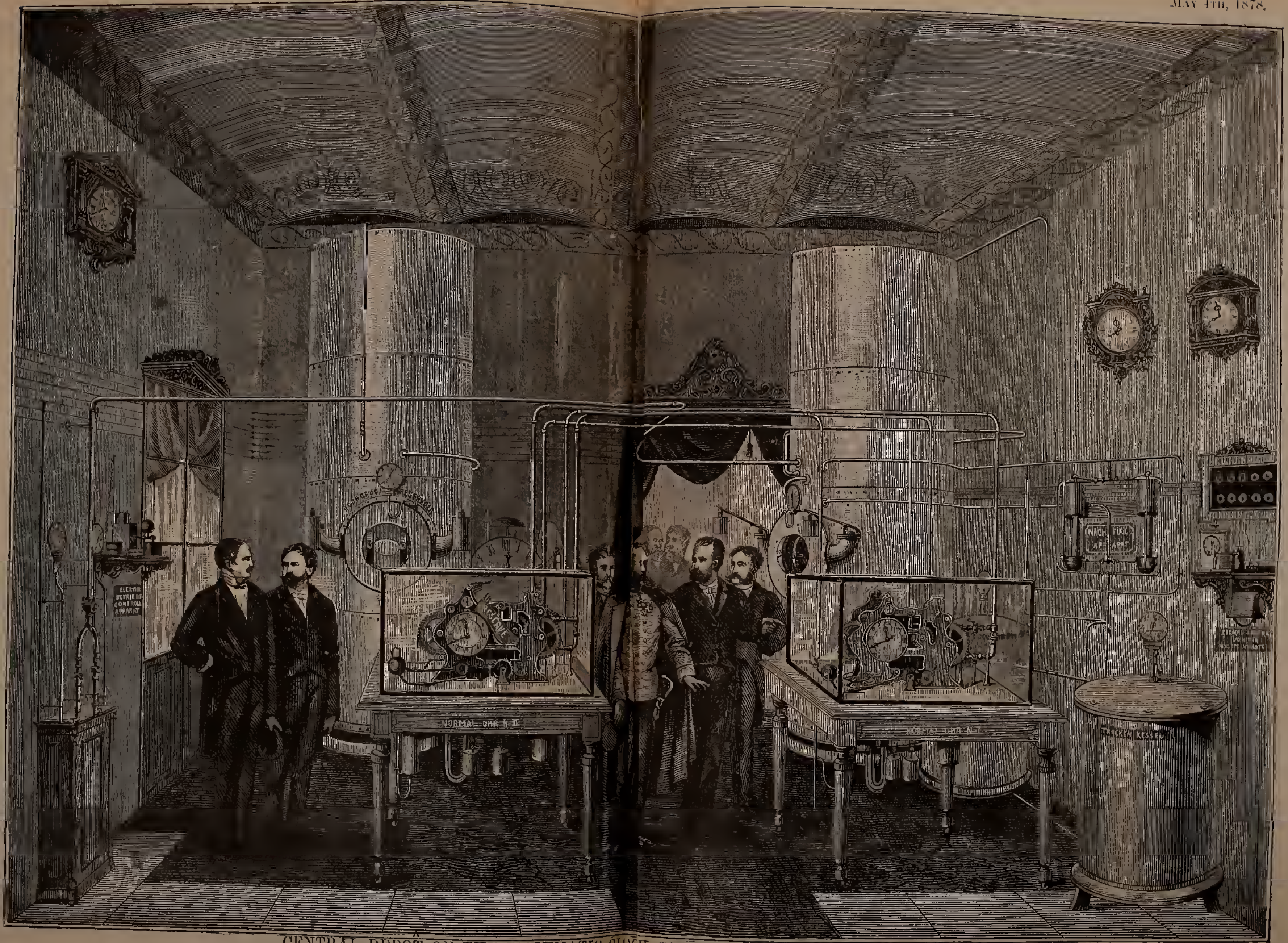
K COMPANY AT VIENNA. (*See page* 246.)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CENTRAL DEPÔT OF THE PNEUMATIC CLOCK COMPANY AT VIENNA. (*See page* 246.)

CORRESPONDENCE.

It must be distinctly understood that we do not necessarily identify ourselves with the opinions or views of any of our Correspondents. Our pages are alike open to all for free discussion of questions connected with the various trades which we represent, and all Correspondents will find every opportunity afforded them for expressing their opinions.

MR. WILLIAMS' PAMPHLET.

To the Editor of the Watchmaker, Jeweller, & Silversmith.

Sir,—It is a fine and true saying of Bacon, that "reading makes a full man, talking a ready man, and writing an exact man." Not having the pleasure of Mr. Williams' acquaintance, I am unable to form an opinion of his readiness; but in his published writings before me I find neither fulness nor exactness. His pamphlet, which is stated to be a reply to myself, is written simply from the standpoint of a manufacturer. He is evidently of opinion that the Government of his country should exercise a paternal control over his trade, and that the interests of manufacturers should alone be considered in commercial legislation. This is a doctrine which will hardly commend itself to the many thousands of retail dealers who, rightly or wrongly, conceive themselves equally entitled to consideration. Had Mr. Williams been "a full man," he would have known that the standpoint of a Government should be that of consumers. Its duty, as is generally understood by well-read men at the present day, is to frame laws so as to benefit the people —not manufacturers exceptionally. It is true that laws which are framed in the interests of consumers are pretty generally found to increase the prosperity of manufacturers. That such would be the case in the gold and silver trades, if Free-trade principles were applied to them, may be regarded as certain. Decreased cost of production would inevitably lead to increased consumption; and even increased competition, should foreign plate be admitted free, would have the very best effect upon the prospects of such manufacturers as would aim at improvements in production. The fact that foreign pianofortes are freely admitted into this country has not ruined Messrs. Broadwoods' or Collards'. On the contrary, it has led those firms to make improvements which have given to their names a world-wide renown. The same may be said of many other trades. Foreign watches, foreign carpets and furniture, foreign jewellery, and dozens of other articles can be freely imported into this country, but they have not been found to interfere with English manufacturers, who have wisely kept pace with the times. However, let me thank Mr. Williams for so kindly "placing the matter, as far as he is able, in its true light before the trade and the public." Well may it be said, "What is truth?" This, then, is "the true light" according to Mr. Williams:—

1. Mr. Watherston "not being a manufacturer, his views are drawn from theory rather than practice." Therefore, "the editorial remarks that have been made in favour of Mr. Watherston's views are founded upon an imperfect knowledge of the subject, and are calculated to mislead the mind of the public."
2. That "the duty on silver plate does *not* militate against the prosperity of the trade."
3. That "without the Hall-mark the silver trade would be ruined."
4. That "if the duty be repealed, the present laws for preventing fraud would in time get relaxed" . . . . . "the withdrawal of the duty would be equivalent to the withdrawal of the guarantee afforded by the supervision of the Government."
5. That "silver is a luxury in which only the wealthier classes indulge, and who should pay taxes if they do not?"
6. That "any one who can afford to pay seventy or eighty shillings for a dozen of silver tea-spoons can afford to pay ten shillings extra to ensure an article of the quality he pays for."

Had Mr. Williams been "an exact man," it is not an unfair conclusion that he would not have written such unutterable nonsense. Indisposed as I am to believe that manufacturers possess a monopoly of intelligence, and that retail dealers possess only an imperfect knowledge of their trades, I would beg Mr. Williams and others to understand that retail dealers possess a much more perfect knowledge of buyers of articles than do manufacturers. That their interests have a far greater claim upon the consideration of the Government must be admitted. Manufacturers may be counted on one's fingers. Retail dealers comprise many thousands. It is the interest of those thousands to sell anything, of any quality, whether of foreign or of home production, to any customer whom they may be able to find willing and able to purchase. And it is the interest of the Government that such should be the case. It is to this principle that the Chancellor of the Exchequer owes the increased return of income tax. Supposing that there were such insane laws as that no one should buy any but "standard" pianofortes, carriages, silks, jewellery, long cloth, carpets, electro-plate, linen, and such like goods, would the Chancellor of the Exchequer have found a penny in the pound to have produced £1,940,000? Mr. Williams' theory would be a poor one for a Chancellor of the Exchequer to adopt. He may be a good manufacturer of spoons and forks, but he knows very llittle of finance.

The same may be said with reference to "duty." All duties, "as they raise the price of commodities taxed discourage consumption, and therefore production," says Adam Smith. But Adam Smith was not "a manufacturer;" therefore "his views were founded upon an imperfect knowledge of the subject." Thus I suppose the science of political economy is all wrong, because the authors and writers—philosophers they are usually termed—were not manufacturers. Mathematics, possibly, is wrong also, because Euclid was not a builder. Will Mr. Williams commit himself to such a deduction from his premisses? If his theory is to stand at all, it must stand on some other foundation.

Again, "Without the Hall-mark the silver trade would be ruined." This is a hard saying. The Hall-mark dates from Edward I. The duty from 1719; latterly from 1784. Was the trade ruined prior to 1719? Was it ruined between 1758 and 1784? Has the duty anything whatever to do with Hall-marking? A reference to the Acts of Parliament is alone necessary to prove the absurdity of this proposition. But enough; I will no longer trespass upon your valuable space. A perusal of Mr. Williams' pamphlet by any attentive reader will satisfy all but those whom prejudice and ignorance have rendered blind that, if the duty upon silver plate is to be maintained, it must have a foundation very different from that upon which his arguments are based.

I have the honour to be, Sir,
Your obedient servant,
12, *Pall Mall East, London.* Edward J. Watherston.

Fashionable Jewellery.—The fashionable bracelet is now the long serpent of gold or silver, which winds round and round the arm, and is finished with a jewelled head. Very beautiful also are the neat brooches composed of the whole Christian name, or of such words as "Remember," "For ever," "Souvenir," and so on, formed entirely of diamonds or fine pearls, and standing out in relief with just the very least possible setting. Lockets are worn very large, with paintings in enamel in the Louis XVI. style, with pearl setting all round, or of dead gold with monogram in small pearls or diamonds. Pink coral has come into fashion again. Large coral-headed pins are worn upon coiffures and cravats, and also in the hair. Rings like brooches are formed of letters comprising some word or motto.

Two turret clocks have been erected in the Paris Exhibition Buildings, one at the Trocadero, the other at the Champ De Mars. They are regulated from the Observatory, and will thus supply standard time to the numerous other clocks in the various departments.

PNEUMATIC SYSTEM OF REGULATING CLOCKS IN VIENNA.

IT is now some thirty years since Dublin first startled the world with its pneumatic railway project; but although the idea was then ridiculed, pneumatics have since been successfully employed in various branches of industry. We will only mention the pneumatic house telegraphs, the pneumatic post in London, Paris, Vienna, and Berlin, and the boring machines used in the construction of the Mount Cenis Tunnel; ample proofs of the great value of this new power in the service of man. It has now also been applied in connection with the transmission of time, and the results of a twelvemonths trial have surpassed anticipations.

Besides obtaining the greatest possible precision in timekeepers, physicists have exercised their inventive geniuses in contriving some system by which a number of clocks could be kept in motion by a standard clock. In order to gain this object, electricity was called in, and not only have electric clocks been established in railway-termini, post offices, factories, etc., but public clocks have been connected with each other by the same means in England, America, France, Belgium, Germany, and Switzerland. Our old English proverb, "Time is Money," is now recognised by every man of progress, and it may be safely asserted that the degree of perfection in the timekeepers which a country employs, is also a fair indication of the degree of education prevailing in that country. Whoever is acquainted with the many disturbances to which electric apparatuses in general are liable, especially if the conductors are exposed to all atmospheric influences, will readily believe, that to keep a number of clocks constantly at a uniform rate, is an extremely difficult task. Air-pressure has, however, the advantage of being independent of atmospheric disturbances and of costly and not always reliable batteries. The inventor of the pneumatic system, Mr. Mayrhofer, deserves credit for the skill and perseverance with which he pursued his object, as, from what we hear, he had to battle against numerous difficulties and disappointments. In 1864, he first made an offer to the Corporation of Vienna to erect a series of public clocks, to be regulated by electricity.

Leipzig was at this time the only city which could boast of such an arrangement; but the Viennese authorities declined the project. As many as twenty-six European and almost all American cities have since adopted the electric system in spite of the drawbacks to which it is subject. Mr. Mayrhofer laid his plans again before the Council in 1869 and 1872, but with no better success, as the experiences made elsewhere only helped to convince that body that the desired object of *uniform clocks* was not to be gained by electricity. Nothing daunted, Mr. Mayrhofer set to work again with a view of solving the problem by another medium, and in 1875 he submitted his pneumatic project. The first trial was made before the Society of Engineers in presence of a number of scientific authorities, and the results proved highly satisfactory. After a public exhibition in August, 1876, Mr. Mayrhofer's system was sanctioned by the council, and has now been in full operation since February of last year.

Messrs. Victor Popp and Ernest Resch, both of Vienna, also deserve honourable mention for the liberal manner in which they supplied the necessary funds for the realisation of the project.

The Central Depôt of the pneumatic clocks in Vienna is at 39, Wipplingerstrasse. A standard clock with a pendulum of 994,07 $^{\text{mm.}}$ (the pendulum length for Austro-Hungary's geographical position) sets a mechanism in motion which drives all the clocks included in the net, by pneumatic means. A wave of compressed air is conducted through air-tight tubes laid along the street gas mains to all the public clocks wherever they are, and which regulates them all at the same moment. The lamp-posts are mostly used for carrying the auxiliary clock works, and are provided with a triple dial. All the clocks are regulated from minute to minute by the standard clock at the Central Depôt, which is in its turn regulated from the Imperial Observatory by a signal arriving at 11.45 a.m. daily.

Pistons, floating on columns of mercury in corresponding cylinders, are lifted by the standard clock in such a manner, that the minute wheels are turned by leverage; the movements of all the clocks being, therefore, under the direct influence of the standard clock. This arrangement has the advantage that all clocks can be connected with the system without much cost; the works consisting only of the hour and minute wheels, and the lever and piston mechanism. The manner in which the air is compressed in reservoirs and regulated to half an atmosphere is highly interesting. The two air-boilers (4 metres high, and 1½ metres wide), visible in our supplement, are first filled by a motor; the pressure in the left one is on an average from two to four atmospheres, but only half an atmosphere in the other. By the running off of the wheelwork stationed to the right of the standard clock, the valve opens, and the compressed air from the acting reservoir enters the tube-net and sets all the secondary clocks in motion. After a few seconds the same wheelwork closes the valve again, and the half atmosphere of compressed air returns by the three-way cock. In the intervals, when no pressure exists, the tubes are filled by ordinary atmosphere. A supplementing tube leads from the high-pressure boiler to the supplementing apparatus, and through these and the dry boilers into the acting reservoir. The supplementing apparatus consists of two cylinders, the bottoms of which are provided with receptacles containing quicksilver. On these mercurial columns rests an ivory float with a vertical rod, and which effects the opening and closing of the transmission cock. This apparatus serves the purpose of securing to the acting-reservoir the constant supply of just half an atmosphere. As already mentioned, there are also two dry boilers at the Central Depôt, filled with lime, to absorb the water from the air, so that only dry air gets into the acting reservoir and tube-net. The electrical contrivances which are found near the regulating apparatus serve only to notify any disturbances in the system, and exercise no influence whatever on the movements of the pneumatic clocks. It is, therefore, impossible that any part of the acting apparatus could occupy any but its proper position without at once indicating the change by an electric signal, and that before any disturbance could have occurred. In order to enable the official in charge to discover at once from where the signal comes, an index similar to those used for house-telegraphs is applied in the Central Depôt. The conduit consists of leaden pipes, safely secured from outward impressions by specially formed bricks.

Besides the public clocks, a large number of those in public and private buildings are now included in the system, and its application would no doubt have been still more extensive but for the resolution of the company not to increase its capital till the first year's trial should have successfully ended. The invention will not be long in spreading elsewhere. A company for the working of this patent was formed in Paris in July last with a capital of £80,000, and we hear that steps have also been taken to introduce the system in London. For the particulars relating to the working of the pneumatic clocks we are indebted to our Berlin contemporary the *Deutsche Uhrmacher Zeitung*. The supplement which accompanies our present issue represents the interior of the Central Depôt in Vienna on the occasion of a visit of inspection by the Emperor Francis Joseph.

THE part of "Madame du Barry" in *Joseph Balsamo* is played by Madame Léonide Leblanc. The dress worn by the actress is the talk of Paris. It cost 12,000 fr., and is decorated with jewels of the value of £20,000. By way of protecting her property she has purchased a bloodhound, which accompanies her to the theatre, and during the performance remains in her dressing-room.

TRADE RECIPES, &c.

A foreign watchmaker strongly recommends the use of petroleum for the oilstone.

To Colour Brass Blue, like Steel.—The brass, laid in a leaden vessel containing hydrochloric and a little arsenic acid, assumes iridescent colours, and may be removed when the desired shade of blue is obtained.

Gold Lacquer for Brass.—Dissolve in about 12 ozs. of alcohol ½ oz. shellac, 1 drachm dragon's blood, and ¼ drachm turmeric root. It is sometimes necessary to filter the varnish. It is applied as usual. At first the varnish will seem to be a failure, but in a short time it will have a beautiful colour.

Improvements on Wollaston's Process of Drawing fine Platinum Wire.—It is said that M. Gaiffé by some ingenious improvements has succeeded in rendering Wollaston's process available for industrial purposes. Some wire of only 1·47mm. in diameter was exhibited before the French Academy of Sciences.

Safe and Easy Silver Test.—Scratch the article with the usual testing stone, and apply a little aquafortis. Then lay two or three grains of salt on the spot; and, if pure silver, a milky froth, principally a deposit of dissolved silver, will be found under these grains, while in the case of base metals the salt will turn green, and no deposit is to be seen.

Gilding Watch Wheels, Bridges, &c.—Watchmakers, having but little practice at this kind of work, find it often difficult to obtain good results without repeated trials. These failures are often due to the scratch-brush itself, as will soon be discovered if the spun-glass brush of the jeweller is used instead of the ordinary one in use among watchmakers.

To Dye Wood Ebony-black.—A correspondent to the *Revue Chronométrique* prepares a mordant for this purpose as follows: Dissolve extract of logwood in boiling water till the solution marks 10° R., then mix five litres of this solution with two and a half litres of pyrolignite of iron at 10° R., and half a litre of acetic acid at 2° R. Heat the mixture for a quarter of an hour, and the dye is ready for use. It has the advantage of being applied cold.

Silver Testing Solution.—A simple, sure, and expedient silver test solution is obtained by dissolving Kalium bichromaticum in water with the addition of a little sulphuric acid, which gives the solution a blood-red appearance. Scratch the object with the stone and apply the solution; if silver, a red sediment will remain; but if base metal the coated parts will disappear or turn yellow. The testing stone must be well cleaned after using.

Indiarubber Varnish.—Cut the rubber in strips, boil it in water for an hour; then dry slowly and reduce it to small fragments. Take

Rubber prepared as above	26 parts
Benzine	50 ,,
Essence of Turpentine	70 ,,

Macerate for twenty-four hours in a covered vessel, assisting dissolution by trituration. If a black varnish is desired add a few hundredths of soot.

Vienna Lime for Polishing.—Vienna lime is a pure anhydrous lime, and is obtained from Vienna. It is extensively used in Switzerland and Germany for final polishing purposes. The mode of its preparation is not well understood, but from the evenness of its particles we should suppose that the carbonate of lime from which it is obtained is first pulverised to the finest powder, and then elutriated. The last precipitated from the water will be the finest. The water is now drawn off, and the dried, and finally the resultant mass, burned in the ordinary way in a kiln or oven. There is a very singular fact about the action of the lime when used as a polishing material, for it seems that the effect is not produced, as in the case of rouge, by simple abrasion, for unless the lime be used while it is slacking, the result will be very unsatisfactory. The material should, therefore, be kept in air-tight bottles, and but just enough for the occasion to be taken out at a time. The way to use it is extremely simple, and may be summed up in a few words. Having taken a small lump from the bottle, it is just moistened with water, and then broken down with any convenient, but clean tool. Having provided yourself with a slip of boxwood, you spread some of the lime paste on it and apply it to the article, using quick strokes. To polish screw heads, you should have a section of boxwood planed on the grain as truly as possible, and the screw head must be applied to the surface on which some of the paste has been spread. Boxwood may be superseded by any other fine-grained wood, though it is superior to any other of which we have cognisance.

A Simple Method of ascertaining the Specific Gravity of any Gem.—The stone is first weighed in the ordinary manner in the scales, and having noted the exact weight, it is then fixed by means of a piece of wire, bent in the form of a hook, and a small piece of wax to one side of the scale, whilst in the other is placed a piece of wire and a piece of wax of the same weight, or their equivalent in weights. The scale with the stone attached is now allowed to fall in a cup of distilled or even filtered water, and weights are put in the opposite scale till the weight of the stone is counterbalanced, and the scales exactly even. It is evident that a less weight is required to counterbalance the stone submerged in water compared with that when it was weighed in the air, as the water in some measure supports it. The weight in water is then subtracted from the weight in air, and the weight in air divided by the difference, viz. :—

Weight in air	17 carats,
Weight in water	12 ,,

$$5 \div 17 = 3{\cdot}5'.$$

In order to ascertain the specific gravity of a stone accurately, the following conditions must be fulfilled: The gem must be perfectly clean, and free from dust, grease, or any adherent substance. It must be free from holes or porosities; and before being weighed in water it must be rubbed in it to remove the adherent air, and if the stone be of a porous description it must be allowed to absorb as much as it is capable of before being weighed. The ascertainment of the specific gravity is a matter of great necessity for the proper comprehension of gems. It affords in many instances a test of the greatest value, and prevents the possibility, when the specific gravity differs, of one gem being substituted for another, such as jargoon and white sapphire for diamond, which occasionally happens by fraud or error; also in the case of stones which are cut and polished it is a valuable assistance in determining the family to which they belong without the possibility of the slightest injury to the gems. There are many valuable instruments made for determining the specific gravity, the hydrometer, &c., which may be used where great accuracy is required, such as in scientific experiments, but for all ordinary purposes the manner I have indicated will suffice. This test was well known to the ancients, and was practised in India several centuries ago.—*H. Emanuel, F.R.G.S.*

A Clock Wanted.—At the assizes in Shrewsbury, Mr. Justice Denman, while presiding at Nisi Prius, remarked, during the hearing of a case, that it was the most barbarous court he had ever sat in. There was no clock in it, and he could not understand why the county of Shropshire should be satisfied with such a state of things."

A Chronometrical Calculation.—*Scene: Hyde Park Corner.*—*Swell*: "A—may I trouble you to tell me the—a—time?" *Jollyboy*: "Pleasure, I'm sure. Let me see. When I pawned my watch it was just nine by it. Half an hour's walk from 'Uncle's' here, two glasses of sherry at the Criterion, say seven and a half minutes each, that would be—yes—a quarter to ten—*exactly!*"—*Funny Folks.*

WASHING WITH SILVER.

COPPER articles can be covered with an almost imponderable layer of silver. Some idea of the thinness of this layer can be imagined when we think that, inclusive, of material, labour, capital, etc., the cost of silvering 1 lb. of corset eyelets is only 6¼ cents; while 1 lb. of buttons, suspender buckles, pins, etc., cost from two to three cents, while a grain of pure silver is worth five cents.

The method of washing these articles with pure silver is thus described by Roseleur in the *Metallarbeiter*, p. 316: Any desired amount of granulated silver is dissolved in twice its weight of nitric acid. The solution of nitrate of silver is then diluted with distilled water, and precipitated by a solution of table salt or hydrochloric acid, when a white cheesy precipitate is produced which soon settles (especially if stirred). It is easy to ascertain whether all the nitrate of silver has been decomposed, which is the case when a drop of the salt solution does not produce turbidity in the clear supernatant liquid over the precipitate. The liquid is poured off and the precipitate washed by decantation repeatedly with distilled water to remove all free acid. If it is necessary to preserve the chloride of silver some time before using, it must be carefully protected from the light, because under the influence of light it changes rapidly and acquires a bluish colour.

The chloride of silver is then intimately mixed with a little water and at least 80 per cent. of tartar (bitartrate of potash), and the whole preserved in a stone pot. The composition of the mass is found to be extremely varied, for to the tartar is added a quantity of other substances like sulphate of soda, common salt, quick lime, magnesia, corrosive sublimate, etc., most of which, if not exactly injurious, are at least perfectly useless. We give here a formula, somewhat cheaper than when tartar alone is used, which gives very good results: Chloride of silver from 30 grammes of silver; pulverised tartar, 2½ kilos.; table salt 2½ kilos. Some persons employ the salt alone without any tartar, but the silvering is then rather bluish.

When the paste is ready, some water is heated to boiling in a vessel of red copper, and one or two spoonsful of the paste thrown in it, which dissolves more or less. In a bath prepared in this way, the articles to be silvered must either be suspended from hooks or contained in a colander; usually a second vessel, less deep than the first, and full of holes, is set against it, resting upon edge of the first, so that the articles in it are covered to a certain depth with the bath. When the silvering is ended it can be removed without wasting any of the solution. The articles are stirred around with a wooden spatula.

In each operation a quantity of paste, proportional to the surface of the articles to be washed, is added.

This silver bath improves by use, and finally acquires a dark green colour from the dissolved copper, which takes the place in solution of precipitated silver.

The silvering is not so perfect as the gilding in gold washes. They generally make use of the useless acids as in coppering. They are polished by means of sawdust, scarcely ever by means of a brush.

The smallest quantity of iron, zinc, or tin in the bath spoils it, for all brass and copper articles then turn red.

The iron is first removed by means of a magnet. Little splinters of zinc are removed by treating the article with very dilute hydrochloric or sulphuric acids, which do not attack copper when cold. Tin or lead, which, however, are seldom present, must be removed by hand. If, for any reason, the silvering did not succeed, the articles are subsequently dipped for a few seconds in boiling solution of nitrate of silver, 100 parts; cyanide of potassium, 600 parts; water, 1,000 parts. This bath, which does not keep long, increases the lustre and the whiteness of the articles considerably.

Another mixed process, which stands intermediate between dry and wet silvering, is the "paste process," and is also called thumb silvering, stuffed, or pencil silvering (*daumen*, *stopfen*, and *pinsel* in German). These methods, whose results possess no considerable permanence, but still are much better than the washing process, frequently serve to repair the small breaks in better silvering, and also to produce on thinly gilded articles a mixture of gold and silver, or gold with so-called oxidised silver. The portions which are to be left unsilvered are simply varnished.

The paste for this process is made by grinding in a mortar, or with a muller upon a plate, excluding the light as far as possible, an intimate mixture of the following substances: Fused nitrate of silver, or, better, chloride of silver, 100 parts; binoxilate of potash, 300 parts; tartar, 300 parts; table salt, 420 parts; sal ammoniac, 80 parts; water, 100 to 150 parts. Or take chloride of silver, 60 parts; tartar 200 parts; table salt, 300 parts.

The mixture is ground as fine as possible in the mortar, then ground with a muller upon a thick piece of ground plate glass, until no grains are felt when pressing it between the fingers. This paste is kept in a black bottle, or a jar of opaque material, to protect it from the light, which rapidly decomposes it.

When about to use it, a small quantity is triturated with some water in a glass or porcelain dish, and the mass applied with brush or pencil to an article completely covered with gold, either by dipping or electro-plating, where the gold is so thin that the paste can be decomposed through it by the copper. It is then allowed to dry, and warmed. The dry paste exhibits a pink or perfectly green colour, according to the thickness of the gold plate and the consequent strength of the chemical reaction. The latter colour indicates that a considerable quantity of the copper is dissolved, and in consequence a corresponding amount of silver has been reduced.

The salt that sticks to the article is removed by washing with cold water. The silvering is then pretty but dull, and its lustre and whiteness are increased by dipping for a few seconds in very dilute sulphuric acid, or better, a solution of cyanide of potassium.

This silvering will bear brushing and polishing, and can also be oxidised: hence it is easy to see that it is preferable to the washing or boiling with silver first described.

In case the first deposit has not been thick enough to make it sufficiently durable, it can be repeated after polishing, a second or third time.

By the use of this mixture upon non-gilded copper, the silvering is less white and not so durable as upon the gilded articles.

The different powders and liquids which are met with in commerce under the names of silver water, plate conservator, California liquid, etc., and which are used in restaurants and cafés to repair their worn off silver-plate, are nothing more than some of this paste suspended in pure water or salt water.

In America, silvering solutions are usually some poisonous mercurial compound which forms with the brass or copper a brighter and silverlike amalgam, which lasts just long enough for the guilty pedlar to effect a safe retreat before its brightness disappears.

These liquids must not be confounded with others sold under the pompous names of "aurophile" and "argentophile," which latter are intended to freshen up old gilded and silvered articles by dissolving the layer of oxide formed on the surface. These fluids are simply solutions of cyanide of potassium, which was formerly recommended for this purpose. They are most violent poisons, and ought under no circumstances to be tolerated in the kitchen.—*Scientific American.*

It is announced that ex-Queen Isabella of Spain has been obliged to sell her diamonds. They are valued at about £80,000 sterling.

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from page* 203.)

IN the South Kensington Museum is an Augsburg clock, in bronze, with a dome-shaped cover, perforated and engraved with rich scroll-work. The sides are engraved with the story of the Good Samaritan. The height is five inches, the width five inches, and the diameter four inches and a quarter. It was purchased at the Bernal sale for £9 10s. Also a table-clock in a hexagonal gilt silver case, with cartouche ornaments and masks in silver. It is of Augsburg work. Its height is three inches and a quarter, and its diameter four inches. It was purchased at the Bernal sale for £11. Also an Augsburg clock in metal gilt, with a square pavilion-shaped case, domed top, and cover surmounted by a statuette of Hercules and the Lion. The case is richly chased and engraved with arabesque ornaments, fruits, and flowers. It has a dial on both sides. Its height is fourteen inches and a half, its width eight inches and a quarter, and its diameter seven inches and a half. It is of the sixteenth century; and was purchased at the same sale for £19 10s. Also an Augsburg clock in metal gilt, in a pavilion shaped case with two dials. At the summit is a female allegorical statuette standing on a globe. The angles of the case are decorated with sea-horses. This clock is of the sixteenth century, and its height is thirteen inches and a half, its width eight inches, and its diameter six inches. It was purchased for £90. Also an Augsburg clock, upheld by a figure of Atlas on a richly engraved and perforated vase; the upper part surmounted by a smaller disc-shaped vase and a small female statuette. The height is fifteen inches and a half, and the diameter of the large disc is six inches and one-eighth. It was purchased for £30.

Viscount Hawarden has a cylindrical gilt timepiece, ornamented with arabesques, spraywork, and figures. It rests on three legs, composed of masks and goats' feet. It is of the sixteenth century and Augsburg work. Mr. A. Barker possesses a gilt metal Augsburg clock of the same date, square in shape, with columns at the angles and a dome perforated top. Also a square gilt Augsburg clock, with pilasters at the angles, cupola top engraved with scrolls. And a square, gilt table-clock, resting on four knobs, of the seventeenth century. At Goodrich Court is a curious table-clock of German manufacture, the engravings of the costume on which show it to be of the time of Queen Elizabeth. It has two bells, one to strike the hours, and the other the quarters. Besides the larger front dial, it has two smaller ones, one with the twelve and the other with the twenty-four hours, each having indices that move at the same time as the hands of the larger one. At the sides are dials to show how many times the greater bell has struck the hours, and what quarter the smaller one. At the back is an astrolabe surrounded by a circle of twenty-four hours, and an index for astronomical purposes. The pendulum works outside. The whole is about fourteen inches in height, and is of metal partly gilt and partly silvered.

In an aisle near the choir of the Cathedral of St. John at Lyons is a very curious clock, on the top of which stands a cock, that every three hours claps his wings and crows thrice. In a gallery underneath, a door opens on one side, and out comes the Virgin Mary, and from a door on the other side the angel Gabriel, who meets and salutes her. At the same time a door opens in the alcove part, out of which the form of a dove, representing the Holy Ghost, descends upon the Virgin's head. After this these figures retire, and from a door in the middle comes forth the figure of a reverend father, lifting up his hand and giving his benediction to the spectators. The days of the week are represented by seven figures, each of which takes its place in a niche on the morning of the day that it represents, and continues there until midnight. The greatest curiosity is an oval plate marked with the minutes of an hour, which are exactly pointed out by a hand reaching the circumference, that insensibly dilates and contracts itself during the revolution. This curious machine, although not so perfect now in all its movements as when it was originally constructed, has suffered but little injury during a long course of years, owing to the care and skill of those who were appointed to look after it. It appears from an inscription on the clock itself that it was repaired and improved by one Morrison in 1661; but it was contrived long before that time by Nicholas Lipp, a native of Basle, who finished it in 1598, when he was about thirty years of age. The oval minute motion was invented by M. Servier, and is of later date There is a tradition that the ingenious artist, Lipp, had his eyes put out by order of the magistrates at Lyons, that he might not be able to make another clock like this; but so far from this being true, the justices of Lyons engaged him to take care of his own machine, at a handsome salary. Many ancient clocks exhibited processions of saints who devoutly made obeisance to the Virgin and Child; and scarcely a town of any note upon the Continent was without some clockwork automata of strange conceits peculiar to itself. But the "serious vanity" of the mimicry was not calculated to produce any thrill of devotional awe, or the least impulse of veneration: it gratified only the sense of seeing.

Shakespeare frequently mentions clocks in his plays, showing that they were then common. The following are, perhaps, the most noticeable references made by him to them:—

Biron. What! I! I love! I sue! I seek a wife!
A woman, that is like a German clock,
Still a repairing, ever out of frame,
And never going aright.—*Love's Labour's Lost.*
Spring. When shepherds pipe on oaten straws,
And merry larks are ploughmen's clocks.
Love's Labour's Lost.

Rosalind. I pray you, what is 't o'clock?
Orlando. You should ask me what time o' day;
There's no clock in the forest.
Rosalind. Then there is no true lover in the forest: else sighing every minute, and groaning every hour, would detect the lazy foot of time, as well as a clock.
K. Rich. For now hath time made me his numb'ring clock;
My thoughts are minutes, and with sighs they jar
Their watches on to mine eyes, the outward watch,
Whereto my finger like a dial's point,
Is pointing still, in cleansing them from tears.
Now, sir, the sound that tells what hour it is
Are clamorous groans, that strike upon my heart,
Which is the bell. So sighs, and tears, and groans,
Show minutes, times, and hours; but my time
Runs posting on in Bolingbroke's proud joy,
While I stand fooling here, his Jack o' the clock.
Richard II.

The last line has reference to some automaton figure which struck the hour in a public clock's bell; for instance, one of St. Paul's Jacks. Dials, as well as clocks, are named by Shakespeare in his plays; but the latter are more frequently mentioned.

Jaques. And then he drew a dial from his poke;
And, looking on it with lack-lustre eye,
Says very wisely, "It is ten o'clock."
And I did laugh, sans intermission,
An hour by his dial.—*As You Like It.*

This was probably a pocket sundial, which was an article not uncommon at the time when the play was written.

Hotspur. O! gentlemen, the time of life is short;
To spend that shortness basely were too long,
If life did ride upon a dial's point.
Still ending at the arrival of an hour.—*Henry IV.*
Arch. of Cant. As many lines close in the dial's centre;
So many a thousand actions, once afoot,
End in one purpose.—*Henry V.*
King Henry. O God! methinks it were a happy life
To be no better than a homely swain;
To sit upon a hill, as I do now,
To carve out dials quaintly, point by point,
Thereby to see the minutes how they run.
Henry VI., Part III.

(*To be continued.*)

DUCTILITY OF METALS.

THE ductility of some metals far exceeds that of any other substance. The gold-beaters begin with a ribbon an inch broad and 150 inches long, which has been reduced, by passing through rollers, to about the 800th part of an inch in thickness. This ribbon is cut into squares, which are disposed between leaves of vellum, and beat by a heavy hammer till they acquire a breadth of more than three inches, and are therefore extended ten times. These are again quartered, and placed between the folds of gold-beaters' skin, and stretched out by the operation of a lighter hammer to the breadth of five inches. The same process is repeated, sometimes more than once, by a succession of lighter hammers; so that 376 grains of gold are thus finally extended into 2,000 leaves of 3·3 inches square, making in all about 80 books, containing each 25 leaves. The metal is consequently reduced to the thinness of the 282,000th part of an inch, and every leaf weighs rather less than the fifth part of a grain. Silver is likewise capable of being laminated, but will scarcely bear an extension above half that of gold, or the 150,000th part of an inch thick. Copper and tin have still inferior degrees of ductility, and cannot, perhaps, be beat thinner than the 20,000th part of an inch. These form what is called *Dutch leaf.*

In the gilding of buttons, five grains of gold, which is applied as an amalgam with mercury, is allowed to each gross; so that the coating left must amount to the 110,000th part of an inch in thickness. If a piece of ivory or white satin be immersed in a nitro-muriate solution of gold, and then plunged into a jar of hydrogen gas, it will become covered with a surface of gold hardly exceeding in thickness the 10,000,000th part of an inch. The gilt wire used in embroidery is formed by extending gold over a surface of silver. A silver rod, about two feet long and one and a half inch in diameter, and therefore weighing nearly 20 lbs., is richly coated with about 800 grains of pure gold. In England the lowest proportion allowed is 100 grains of gold to a pound of silver. This gilt rod is then drawn through a series of diminishing holes, till it has stretched to the vast length of 240 miles, when the gold has consequently become attenuated 800 times, each grain covering a surface of 9,600 square inches. This wire being now flattened, the golden film suffers a further extension, and has its thickness reduced to the 4,000,000th or 5,000,000th part of an inch.

It has been asserted that wires of pure gold can be drawn of only the 4,000th part of an inch in diameter. But Dr. Wollaston, by an ingenious invention, obtained wires of a platinum much finer than this. Taking a short cylinder of silver about the third part of an inch in diameter, he drilled a fine hole through its axis, and inserted a wire of platinum only the 100th part of an inch thick. This silver mould was now drawn through the successive holes of a steel plate till its diameter was brought to near the 1,500th part of an inch, and consequently the internal wire, being diminished in the same proportion, was reduced to between the 4,000th and 5,000th part of an inch. The compound wire was then dipped in warm nitric acid, which dissolved the silver and left its core, or the wire of platinum. By passing the incrusted platinum through a greater number of holes, wires still finer were obtained, some of them only the 30,000th part of an inch in diameter. The tenacity of the metal before reaching that limit was considerable, a platinum wire of 18,000th part of an inch in diameter supporting the weight of one grain and a third.

PRICES CURRENT FOR GOLD AND SILVER.—VALUE GIVEN FOR OLD GOLD AND SILVER BY ASSAY.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

PRICES CHARGED FOR GOLD AND SILVER.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. 3d. per oz. Standard Silver, 4s. 10d. to 5s. (variable).

CLOCK AND WATCHMAKERS' ASYLUM.

THE Annual Meeting of subscribers was held at the Foresters' Hall, Wilderness Row, on Monday, April 15th. Mr. W. Houghton occupied the chair in the absence of Mr. Collier through indisposition.

The first business was the election of one male inmate and a warden. Three candidates offered themselves for inmates: James Pritchard, clockmaker; J. E. Blake, escape-wheel cutter; and George R. McCormick, case maker. For the office of warden there was but one applicant, Walter Gooch, watch-escapement maker.

The ballot commenced at seven and closed at nine, and the result was as follows:—

McCormick	2,058
Pritchard	807
Blake	34
For warden, Mr. Gooch	1,386

The chairman declared McCormick duly elected an inmate of the Asylum, and Mr. Gooch the warden.

Mr. C. Rowlands having resigned his position as treasurer, Mr. George Moore was unanimously chosen for the office.

Mr. Jackson retired from the Committee, and Mr. C. Bacon was elected in his place.

By the retirement of Mr. Rowlands, who nine years ago succeeded his father, the late Mr. W. Rowlands, in the office of treasurer, the institution loses the services of a most indefatigable worker in its cause. Mainly through his exertions the endowment fund has been increased from £1,600 to £4,600. The Committee can hardly expect to get a man of his energy and activity again; but no better selection could have been made to fill the treasurership than Mr. George Moore, who commands respect throughout the trade. Mr. Jackson thoroughly identifies himself with all associations calculated to benefit the trade, and it is to be hoped his retirement is but temporary.

REVISION OF THE AMERICAN TARIFF.

A MEETING of the manufacturing jewellers of New York was held for the purpose of considering the proposed revision of the tariff now before Congress, which provides that (section 394) "Precious stones and jewellery, diamonds, cameos, mosaics, gems, pearls, rubies, and all other precious stones, and all imitations thereof, whether set or not set, and all other jewellery of every description, including beads and bead ornaments not otherwise herein provided for, should be hereafter admitted at 5 per cent. *ad valorem,* being a reduction from the present rate of 25 per cent." The representatives of the leading manufacturing firms attended the meeting, and, after considerable discussion, a committee was appointed to submit a remonstrance to Congress, on the ground that the condition of domestic trade does not justify such action, nor would it be for the best interests of the country to cut down the tariff to such an extent.

Another meeting was also held by the diamond importers to discuss the proposed reduction in diamonds. At present a 10 per cent. *ad valorem* duty is levied, and it is proposed to reduce this one-half. Considerable difference of opinion was manifested, and the meeting adjourned without taking any definite action in the matter.

IMPROVEMENTS IN MUSICAL BOXES.—Herr Paul Ehrlich of Gohlis near Leipzig has patented a new invention which is said to bring about a complete revolution in the manufacture of musical boxes. We have as yet no particulars about this new system, but we hear that it was exhibited before the Polytechnical Society of Leipzig and caused quite a sensation. The cylinder and pins are said to be entirely superseded.

BOOK NOTICE.

Treatise in Modern Horology, in Theory and Practice. Translated from the French of Claudius Saunier. By Messrs. Julien Tripplin and Edward Rigg, M.A.

Part III., now ready, contains:—*Verge Escapement:* To design a verge escapement; the opening; the lift; the supplementary arc; recoil; inclination of the teeth of the wheel; the relative proportions of these several parts. Details of Construction: The verge; pivots and pivot holes; the balance; the hairspring; to mark the lifting points; to fix the banking pin; the drop; to cut the cock bankings; effects consequent in great variations in the motive force; to examine an escapement. Causes of stoppage and variation in the verge escapement: The wear of the pallets; setting of the balance; other causes of stoppage and of irregularities in timing. *Cylinder Escapement*: Introduction.

A SOLID ACRE OF SILVER.

The *Rocky Mountain Tourist* says: "One of the most remarkable mines in California Gulch is in leads three feet in thickness, the ore from which yields from 240 ozs. to 270 ozs. of silver to the ton, and lies like a coal bank in a stratification of limestone, dipping about 15°. Two openings have been made at points 600 feet apart, and sufficient ore is in sight to make millions of the 'dollars of our daddies.' The owners have gone far enough to know that there is a full acre of the ore in one solid body, and some conception may be formed of the amazing richness of this discovery by a brief calculation of its dimensions. A cubic foot weighs 170 pounds, and, as the ore lies, 12 cubic feet make a ton. There are 43,560 square feet in an acre, and the acre of ore, being three feet in thickness, makes 130,680 cubic feet, which, with 12 cubic feet to the ton, makes 10,900 tons, worth 250 dols. per ton, or the enormous value in the aggregate of 2,700,000 dols. The Crescent is another mine worked like a coal bed, the ore lying horizontally in the large room that has been opened, the roof being held by heavy timbers with very stout caps and tugging poles. The ore breasts from a foot to three and four feet, and occasionally very fine specimens of horn silver are found."

The Largest Sapphire in the World.—Lady Rosebery is the fortunate possessor of what is believed to be the largest sapphire in the world. Her Majesty the Queen, the Czar, and the Duke of Brunswick are supposed, one or other of them, to possess the largest diamond in the world; while the Duke of Westminster owns the biggest turquoise—for which, by the way, he is said to have paid £2,000 some years ago. The history of the Rosebery sapphire is somewhat curious. Some time ago it was brought to England in its rough state, but owing to an imaginary flaw which was supposed to be in it the dealers fought shy of it, and it remained unsold for a long time, until at last a certain broker seeing it made up his mind to run the risk, and bought it for £800, taking all the risk. The lucky purchaser's estimate of the value of the stone turned out to be correct, as, when it was sent to be polished, it was discovered that the supposed flaw was something in the nature of a trivial scratch, and only skin deep. Whether it passed through other hands or not before it was finally purchased by the youthful hope of the Liberal party in the House of Lords we know not; but it ultimately became the property of his lordship, who presented it along with many other jewels to his *fianceé*, Miss Rothschild.

TO MIRA, WITH A REPEATING WATCH.

In the *Gentleman's Magazine* for 1750 appear the following lines:—

"To Mira, with a Repeating Watch.

"Mira! this machine you'll find
Suits a moralising mind.
Has it motion? 'Tis as clear,
Action is man's proper sphere.
Equal should its progress prove,
So thro' life let Mira move.
When you forward urge its pace,
Think it may be Mira's case;
In my passage to the sky,
Have I linger'd? Let me fly!
Backwards are the hands convey'd
To the points from whence they stray'd;
Blush not, Mira! to untread
Steps that wisdom never led.
If it stand, reflecting say,
Time for no machine will stay;
Heav'n observes, and will it find
Mira with him, or behind?
Mark its hands, with thanks to heav'n,
For each hour, and minute giv'n;
Giv'n as means to make us wise;
Giv'n to form us for the skies.
False if either hand be view'd,
Some internal fault conclude;
Thus, if Mira's life should sin,
Let her first reform within.
When it strikes the hours admit
Silence is not always fit.
Ev'ry day its task pursu'd,
Hints how thine must be renew'd.
Say, when winding up, alas!
Human wheels like those of brass,
Soon their functions would forego,
Nought if foreign hand bestow.
If all day it acted right,
When she hangs it by at night,
Then let Mira ask her heart,
How have I perform'd my part?
If it err'd, let Mira pray
Heav'n forgive my faults to-day,
For its use, my present prize,
All besides neglect—despise.
Shine its trinkets as they will,
Trinkets are trinkets still.
Mira, when at court array'd
All in jewels, and brocade,
If at heart no merit dwell,
If no deeds that merit tell,
Tho' a lord should smile, or king,
Thou'rt a glitt'ring useless thing.
If, what e'er its present praise
All its power to serve decays,
Means to mend it vainly try'd,
When you cast it from your side,
On a life of virtue past
Joyful retrospection cast;
But let Mira think again
Only virtue past were vain;
Perseverance till we die
Wins the Christian crown on high."

The total value of the Countess of Rosebery's jewellery is publicly stated to be over £600,000.

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Mr. A. F. WARRILLOW, 101, Great Hampton Street.
Mr. THOMAS LEIGHTON, 21 & 22, Snow Hill.
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PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

1339. OLIVER VAUGHTON, of the firm of Philip Vaughton and Sons, of Birmingham, in the county of Warwick, manufacturing jewellers, for an invention of "Improvements in scarf rings."—Dated 4th April, 1878.

1447. MAURICE MOSELY, of 9, Portsdown Road, Maida Hill, W., for an invention of "A method of securing rings while worn on the finger."—Dated 11th April, 1878.

1473. WILLIAM ROBERT LAKE, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, for an invention of "Improvements in watches."—A communication to him from abroad by August von Loehr, of Prater Strasse, 42, Vienna, in the empire of Austria.—Dated 12th April, 1878.

1608. THOMAS BROWN, of Rood Lane, in the city of London, engineer, for an invention of "An improved watch key or winder."—A communication to him from abroad by Frank Clifford Dennis, of Boston, Massachusetts, United States, of America.—Dated 20th April, 1878.

1664. WALTER HENRY COLLINS, of Great King Street, Birmingham, manufacturing jeweller, for an invention of "Improvements in the manufacture of solitaires, studs, and other similar articles."—Dated 25th April, 1878.

Notices to Proceed.

999. WILLIAM HENRY PEAKE, of Gerrard Street, Soho, in the county of Middlesex, jeweller, has given notice in respect of the invention of "Improvements in bracelets or armlets."

Inventions Protected for Six Months on the Deposit of Complete Specifications.

1304. JULES ERNEST ORRY, of Paris, in the Republic of France, praying for Letters Patent for the invention of "Improvements in the manufacture of neck and other chains," was deposited and recorded in the Office of the Commissioners on the 2nd day of April, 1878, and a Complete Specification accompanying such petition was at the same time filed in the said office.

Grants of Provisional Protection for six months.

1150. LOUIS PREAUBERT, of Nantes (Loire Inférieure), France, ornamental painter, for the invention of "An improved process of bronzing, gilding, and silvering all surfaces in general."

1291. WILLIAM STONE, of 15, Southampton Buildings, London, for the invention of "Improvements in the means and apparatus for securing watches, purses, pocket-books, or other similar articles in the pockets of garments or other receptacles or places."—A communication to him from abroad by Julius Friedlander, of Charlottenburg, near Berlin, Prussia.

1339. OLIVER VAUGHTON, of the firm of Philip Vaughton and Sons, of Birmingham, in the county of Warwick, manufacturing jewellers, for the invention of "Improvements in scarf rings."

Patents Sealed.

4123. JOHN CLAYTON MEWBURN, of 169, Fleet Street, in the city of London, patent agent and consulting engineer, for an invention of "Improvements in watches."—A communication to him from abroad by Charles Delagrave and Ludovic Goillandeau, both of Paris, France.—Dated 6th November, 1877.

4124. JOHN CLAYTON MEWBURN, of 169, Fleet Street, in the city of London, patent agent and consulting engineer, for an invention of "Improvements in clocks."—A communication to him from abroad by Charles Delagrave and Louis Maximilien Grignon, both of Paris, France.—Dated 6th November, 1877.

4126. HENRY EDWARD NEWTON, of the Office for Patents, 66, Chancery Lane, in the county of Middlesex, Civil Engineer, for an invention of "Improvements in the construction of buttons and studs."—A communication to him from abroad by Henri Burtey, of Paris, in the Republic of France.—Dated 6th November, 1877.

4133. JOHN MATTHIAS AUGUSTUS STROH, of Hampstead Road, in the county of Middlesex, for an invention of "Improvements in means or apparatus for regulating the speed of clock-work for telegraphic and other purposes."—Dated 6th November, 1877.

4904. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, patent agent, for an invention of "An improved universal time-piece or geographical clock."—A communication to him from abroad by William Asro Cates, of Union, in the county of Union, and state of Oregon, United Stated of America.—Dated 27th December, 1877.

Patents which have become void.

1077. JOSEPH CHALLANDER, of Manchester, in the county of Lancaster, for an invention of "Improvements in apparatus for illuminating public clocks, which improvements are also applicable to other illuminating purposes."—Dated 24th March, 1875.

Patents Granted in Foreign States.

GERMAN EMPIRE.

914. A. E. MULLER, of Wolfsgraben, near Vienna, for "An implement for obtaining small screws for watchmakers, mechanists, &c."—Dated 26th August, 1878.—Class 49.

920. R. GOTTHEIL, of Berlin, for "A compression apparatus for microscopes."—Dated 22nd September, 1878.—Class 42.

969. P. J. BETBOY, of Paris, for "A protractor compass."—Dated 24th August, 1877.—Class 42.

1001. F. HOLZWURTH, of Cannstatt, for "A contrivance for fastening studs."—Dated 6th October, 1877.—Class 44.

AUSTRIA.

26. Mrs. C. DOMON, of Biel, Switzerland, for "A remontoir watch."—Dated 23rd October, 1876.—Belgian Patent, 26th December, 1876.

41. L. GUTTMANN, of Vienna, for "Widening and regulating clocks by means of an outside remontoir knob."—Dated 10th October, 1877.

79. A. E. MULLER, of Wolfsgraben, for "A system of chronometers for clocks in general."—Dated 16th October, 1877.

34. J. GALLOWITSCH, of Graz, for "A stamp with automatic inking and seal in the shape of a watch."—Dated 26th November, 1877.

52. M. KOTTEK, of Vienna, for "A keyless pendulum-clock."—Dated 27th November, 1877.

FRANCE.

120,769. DESBAZEILLE, of Paris, for a "Clasp for medallions, pendants, &c."—Dated 17th October, 1877.

120,796. FRANKFELD, for "A watch-motion."—Dated 19th October, 1877.

120,828. LAIGLE, of Paris, for "A second-indicator for clocks."—Dated 28th August, 1877.

120,879, BONNAFOUS, of Toulouse, for "Studs for cuffs."—Dated 24th October, 1877.

120,913. DRONIER, for "A metal alloy."—Dated 29th October, 1877.

120,924. LANG and PERRET, for "Applying perpetual calendars to clocks, jewellery, &c."—Dated 29th October, 1877.

120,963. DELAGRAVE and GOILLANDEAU, for "A universal time watch."—Dated 31st October, 1877.

120,999. ALIX, of Charlieu, for "A watch."—Dated 13th November, 1877.

121,054. GAUTIER, for "Elastic bracelets, &c."—Dated 9th November, 1877.

121,124, CRESPEL, for "A remontoir for clocks."—Dated 13th November, 1877.

121,128. RIBALLIER, for "Decolouring tinctured diamonds."—Dated 13th November, 1877.

121,201. SCHMIDT-DOLNE, of Paris, for "Slide-pattens for studs."—Dated 19th November, 1877.

121,202. Schmidt-Dolne, of Paris, for "Rocking patterns for studs."—Dated 19th November, 1877.

121,232, Lefevre, sen., and Co., of Paris, for "Fastening studs and ear-drops, &c."—Dated 20th November, 1877.

121,239. Delepine, for "A construction of alarums and similar articles."—Dated 20th November, 1877.

121,299. Pitolet, for "A suspension for the weights in clocks, turn-spits, &c."—Dated 23rd November, 1877.

121,402. Lejeune, for "Spring fastenings for bracelets, rings, &c."—Dated 30th November, 1877.

121,403. Richomme and Dunet, for "Clock-dials of argillaceous silicate."—Dated 30th November, 1877.

Certificates of Addition.

96,607. Muiron, for "Joints for jewellery."—Dated 20th October, 1877.

117,733. Pulvermacher, for "Producing, applying, and regulating electric currents."—Dated 22nd October, 1877.

119,015. Grignon, for "A universal geographical clock."—Dated 25th October, 1877.

115,663. Lion, for "A bracelet."—Dated 16th November, 1877.

117,023. Henard and Lasnier, for "A cosmographic clock."—Dated 21st November, 1877.

115,608. Vespier, for "A clock-lamp."—Dated 28th November, 1877.

Belgium.

44,542. J. H. Thomas, of Liége, for "Improvements in his electric clocks."—Dated 13th March, 1878.—Original Patent, 1st December, 1877.

44,650. J. E. Orry, for "A chain and necklace and its manufacture."—Dated 23rd March, 1878.—French Patent, 29th December, 1877.

44,703. A. Lion, for "A bracelet."—Dated 27th March, 1878.—Original Patent, 2nd August, 1877.

44,767. T. Freelinghuysen-Breese, for "An improved clock-work."—Dated 4th April, 1878.—French Patent, 26th March, 1878.

Sweden.

33. A. L. J. Pattus, for "A repeating-motion for remontoir-watches."—6 years.—Dated 24th February, 1877.

245. C. Domon, for "Improvements in clock-work."—6 years.—Dated 23rd November, 1877.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

McDermott Martin, 72, Newgate-street, Bishop Auckland, jeweller, &c. March 28. J. T. Proud, solicitor, Bishop Auckland.

Mosely, Alfred, trading as Alfred E. Mosely and Co., 115, St. John-street-road, Clerkenwell, watch manufacturer. March 21. Kisch, Son, and Hanbury, solicitors, 3, Chancery-lane.

Wheeler Thomas, 160, Lancaster-road, Preston, watchmaker. March 27. Cunliffe and Watson, solicitors, Preston.

Zusman, Herman, Wolverhampton, jeweller. March 28. H. and J. E. Underhill, solicitors, Wolverhampton.

Brandon, Edward Ignatius, Fleetwood, Lancashire, jeweller. April 1. H. J. Leach, solicitor, Ridgefield, Manchester.

Dixon, Martin Henry, 89, Barnsbury-road, Islington, gold chain maker, and dealer in jewellery. April 3. S. T. Cooper, 88, Chancery-lane, solicitor.

Hawkins, Ebenezer Alfred, and Frederick Silver, 6, Richard-street, Birmingham, jewellers. April 1. R. Duke, solicitor, Temple-row, Birmingham.

Hawkins, Ebenezer Alfred, 6, Richard-street, Birmingham, jeweller (sep. crdts.) April 1. R. Duke, solicitor, Temple-row, Birmingham.

Henry Alexander, 74, Hatton-garden, dealer in jewellery, &c. April 4. Coburn and Young, solicitors, 54, Leadenhall-street.

Humphrey, Frank Percy, Poulton-le-Fylde, Lancashire, jewellery. April 6. A. F. Morgan, solicitor, Blackpool.

Mendelssohn, Albert, 46, Lime-street, Liverpool, jeweller. April 1. Nordon and Mason, solicitors, 7, Victoria-street, Liverpool.

Silver, Frederick, 6, Richard-street, Birmingham, jeweller (sep. cdtrs.) April 1. R. Duke, solicitor, Temple Row, Birmingham.

Bennett Barzillai, trading as Bennett Bros. and Co., Clayton-square, Liverpool, dealer in precious stones, &c., late Union-street, Liverpool. April 18. T. Etty, solicitor, 22, Unity-buildings, Liverpool, May 7 at 2.

Roberts, Robert Edward, 91, Westgate-street, Canterbury, also Harbour-street, Whitstable, watchmaker. April 15. J. B. Fenton, solicitor, Highgate.

Samuel Douglas Ralph, 28, Old Hall-street, Liverpool, watchmaker. April 16. Snowball and Smith, solicitors, 62, Dale-street, Liverpool.

Scotcher, Nicholas Stuart, High-street, Wrexham, jeweller. April 15. H. Humphreys, solicitor, Wrexham.

Smith, William Henry, 38, Upper-street, Islington, watchmaker. April 16. Coburn and Young, solicitors, 54, Leadenhall-street.

Woolf, Levi, 17, Derby-street, Cheetham, Manchester, jeweller. April 12. J. Sampson, 40, South King-street, Manchester.

Scotch Sequestrations.

Anderson, Robert, Buckie, Banffshire, watchmaker. April 5, with protn. Tr. and Com., Barclay's Commercial Hotel, Buckie, April 18 at 12. Clms. by Aug. 5. Agent, A. Mair, Buckie, solicitor.

Girvin, John, Main-street, Anderston, Glasgow, watchmaker and jeweller. April 11 with protn. Tr. and Com., Faculty Hall, Glasgow, April 23 at 12. Clms. by August 10. Agent, A. Campbell, 109, West George-street, Glasgow.

Kuttner, Wm., Glasgow, jeweller and tobacconist. April 26, with protection. Tr. and Com., Faculty Hall, Glasgow, May 7, at 12. Claims by August 26. Agent, T. J. Smillie, 175, West George-street, Glasgow.

Trustees and Commissioners Appointed in Scotland.

Doig, William, 8, Buchanan-street, Glasgow, manufacturing jeweller. Tr., J. Miller, 71, Queen-street, Glasgow. Com., W. L. M'Kittrick, accountant, J. Henderson, timber merchant, and A. Lowrie, 42, Centre-street, all Glasgow.

Streamer, Marcus, 141, George-street, Glasgow, watch manufacturer, &c. Tr., J. Miller, 71, Queen-street, Glasgow. Com., G. Grimmond, R. Reid, and W. C. Tait, all Glasgow, accountants.

Waldie, Pius, Beauly, watchmaker. Tr., T. Douglas, Inverness, one of the agents of the Aberdeen Town and County Banking Co. Com., E. Mackenzie, Inverness, solicitor, and J. Macdonald, Beauly, painter.

Anderson, Robert, Buckie, Banff, watchmaker. Tr., J. Merson, Buckie, bank agent. Com., J. Macdonald, bank agent, and A. Thomson, fishcurer, both Buckie, and W. Cheyne, Portsoy, writer.

Girvin, Jno., Main-street, Anderston, Glasgow, watchmaker, &c. Tr. W. C. Tait, 65, West Regent-street, Glasgow, Com., A. Boyack, 204, Hope-street, R. L. Hector, Jamaica-street, and T. Lawson, 85, Buchanan-street, all Glasgow.

Bankruptcies Annulled.

Buck, Charles (Dec. 24, 1872), 22, Clerkenwell-green, jeweller. July 3.

Cohen, Moses Jonah (Nov. 7), Ryehill, Newcastle, jeweller. April 9.

Dividends.

Keller, Philip & Emil Hahn (Bkt.), Hatton Garden, London and Birmingham, dealers in precious stones. 2nd div. 4½d.; any Wednesday; J. Seear, 105, Cheapside, London.

Dissolutions of Partnerships.

Pearce, Saml. and Co., 40, Vyse-street, Birmingham, jewellers. Dec. 31.

Allgemeines Journal der Uhrmacherkunst.

Illustrirte Fachzeitschrift fur Uhrmacher.
Redacteur: EMIL SCHNEIDER, LEIPZIG, Germany.
Verlag and Expedition: HOFFMAN & SCHMIDT, LEIPZIG.
Agent for Great Britain and Colonies: H. BUSH'S Publishers' Agency, Hull, Yorkshire.

This journal appears weekly, and will be sent post-paid for 2s. 6d. per quarter or 10s. per aunum. Single copies 4d. Advertisements are charged 3d. per five-parted line.

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R. STACKEL, HOF UHRMACHER.

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PRODUCTION OF ALUMINIUM AT SALINDRES.

IN the almost unique factory for the production of aluminium metal in Salindres, near Alais, the mineral Bauxite is heated with soda in a reverberatory furnace; the resulting aluminate of soda is extracted by means of water and alumina, precipitated by a stream of carbonic acid; this is then formed into balls, with salt and coal, and heated to a white heat in vertical retorts during the introduction of chlorine gas. The double chloride of soda and alumina, which distils over, is fused with the addition of 35 per cent. of sodium and 40 per cent. of cryolite as a flux, and the metal which settles at the bottom of the crucible is poured into moulds. The cost of producing 1 kg. of aluminium is stated to be 80f., while the selling price is 100f.

CIRCULAR MAGNET.—M. Duter recently exhibited at a meeting of the French Physical Society some circular steel discs, which he had magnetised by applying the pointed poles of an electro-magnet to their centre. In these magnets the neutral line between the north and south poles is a circle concentric with the circumference of the disc, and the quantities of north and south magnetism are equal on opposite sides of this equator.

EXHIBITS AT THE INTERNATIONAL.—The Prince of Wales has already sent his splendid collection of jewels and precious stones. The national diamonds of France will also be exhibited in the central hall. A good display of nickel and German silver manufactures will be shown by Messrs. Henry Wiggin and Co., of Birmingham. It will include a nickel plate weighing 30 lbs., measuring 23 inches in length, and 15 inches broad, the thickness being ⅝ inch. It is believed that this is the broadest nickel plate ever turned out of the mould.

THE South African Diamond Fields continue as productive as ever, and several old "claims" have within the past few months changed hands at high prices, while new diggings are from time to time discovered. At the Kimberley Mine, especially, the value of land is very high, and money is plentiful. In Baxter's Gully a piece of land, embracing five "claims," was sold recently for £6,500. Some large stones have been found; one, at Old De Beer's Pan, weighing 50 carats; others, at Dutoit's Pan, weighing 145½ carats, 32 carats, and 23 carats, the last being a perfect water. In Poor Man's Gully, again, a stone weighing 53 carats has been found. Machinery is being adopted in many of the fields, thus reducing the labour to a minimum, and increasing the speed at which the ground can be worked.—*Colonies and India.*

PUBLICATION OF A STANDARD WORK ON WATCHMAKING.

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IN THEORY AND PRACTICE.

BY M. CLAUDIUS SAUNIER,

Ex-Director of the School of Horology at Mâcon; Chevalier of the Legion of Honour, &c., &c., Hon. Secretary of the Paris Society of Horologers.

Translated by JULIEN TRIPPLIN, Besançon Watch Manufacturer, and EDWARD RIGG, M.A., Assayer in the Royal Mint.

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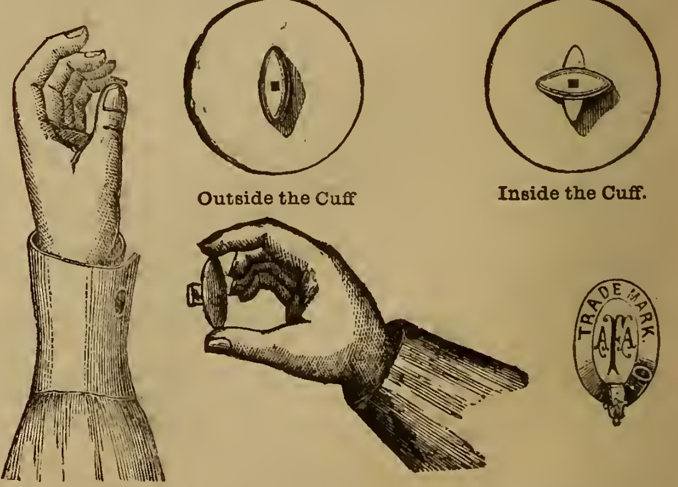
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Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

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HOROLOGY.

(*Concluded from page* 243.)

XXXIV.—Its Relations to Astronomy.

By G. B. Miller.

In the transit instrument for the use of watchmakers a telescope is hung on an axis, the two ends of which are supported in a pair of V's. The great accuracy required in getting these ends of identically the same size, is one of the great difficulties in obtaining a good instrument. A level rests with a pair of W's in the axis, in order to enable the observer to adjust the line of the axial motion to a perfectly horizontal position. On the end of one of the axes is a circle divided into 360 degs., for the purpose of taking vertical angles. In the tube of the telescope is placed a series of fine webs, or a glass plate ruled with a series of very fine lines is substituted for the spider webs—a much better arrangement, as the adjustment is not likely to get out of order. These spider-lines would, however, be useless, unless some method of illuminating them had been devised, and this is effected by making one of the axes hollow, and by means of a lens, the light from a lamp can be condensed and thrown on the field. Here, however, is a difficulty encountered in the very nature of the pivot: the heat from the lamp is apt to expand the pivot, and thus throw the whole instrument out of adjustment. To avoid this source of error, there is generally placed between the lamp and lens a very thin plate of transparent mica, which literally strains the ray, retaining the heat and allowing the light alone to pass into the instrument. By such ingenious devices the errors are eliminated; but even then, there are some that cannot be got rid of, through the imperfection of physical mechanical operations. In instruments of large proportions, such as are used for astronomical purposes, there is a perceptible error arising from flexure of the tube. Some of them are constructed on a better principle, the tube being braced in every direction. Grand as are such instruments, they are not absolutely required in the determination of time. We have in our memory the image of an instrument of fifteen inches focus, that was made of tin plate by the Professor of Astronomy in the institution where we received our first introduction to the stars. The pivots were made of a composition of copper and tin, and were so hard that in turning them off the Professor was compelled to use a turning tool made of agate; and, rude as the instrument looked in comparison with those of very much higher pretensions, it gave results that were but little less accurate than those its more formidable rivals. It will be seen by this that the watchmaker need not look to a splendid instrument only for his time.

In the ordinary instruments there are generally five perpendicular spider lines on the field, with a horizontal one in the centre. The V's are so arranged in regard to each other that while one is firm the other is capable of a small degree of motion, vertically as well as horizontally. This is for the purpose of correcting any departure from truth that may have happened since the last observation; but if the instrument has been put up on a firm base at first, there will be but little occasion for much adjustment. Such is the transit, and we will now proceed to describe its use.

As the earth revolves once every twenty-four hours, any celestial object will appear to pass some certain point of observation at some instant during the twenty-four hours. Now, wherever that point may be on the earth's surface, we know it lies in an imaginary plane passing through the two poles. This imaginary plane is called the meridian of that place, without any reference to longitude; and yet, if this meridian is determined, the difference of time in the passage of any star or other body between that place and the meridian of any other, will give the longitude. The first effort, then, on having obtained the instrument, is to establish such a local meridian line; and in order to save trouble this line should be made permanent, by means of a mark or object placed to the south of the observer—the farther off the better. It should not be determinately fixed until the observer has verified his meridian line and the truth of his instrument. If the circumstances are favourable, the observer should make a northern mark to verify the line, and after this has once been established there can be no trouble subsequently in adjusting the transit.

To establish this much-desired meridian line, the observer having placed his transit with the telescope in as true a north and south line as he can judge by the compass or the north star, and having thus approximated the true line, the next step is by gradual corrections to obtain the absolute. Having temporarily fastened the instrument to a firm base, the observer has his choice of two methods to get his meridian line; thus, if he has his longitude well determined—and at the present date the principal points of the United Kingdom have, by means of the telegraph, been definitely located—the observer may take his local time from such a defined point.

To illustrate this, we will suppose an observer at any point the longitude of which is well ascertained. In looking at the almanac he will find the line at which the planet Jupiter passes the meridian of Greenwich (mean time); to that let him add the westing or subtract the easting and if, at the time resulting, he can find the planet (equating for time) in the central spider-line of the telescope, he has got his instrument very nearly in the meridian. It must be recollected that in this trial the instrument should be carefully levelled by means of the striding level; for, if it is not, all subseqent adjustments will be worthless. The observer, having become satisfied, from repeated observations, that his instrument is nearly in line, may proceed to fix the base permanently, relying on the minor adjustment for greater accuracy. This mode of getting a true meridian line is hardly suitable for one who has not been accustomed to astronomical observation; though in taking Jupiter as the object, we did not intend to cite him as the only one: the moon or the sun can be used, though the greater diameters of these render the observations less accurate.

As the transit is reversible, it may be pointed to the north star; and here is found a much more certain object by which to establish the line of the instrument. Though this star is not situated exactly in the line of the prolongation of the earth's polar axis, its distance from it has been very accurately determined to be at present 1° 24′; so that by the revolution of the earth it describes an apparent revolution around the true north; therefore, in twenty-four hours the whole circle would be 2° 48′.

To be certain of the meridian, it will in every case be necessary to not only take the star Polaris as the greatest elongation, but to reverse the instrument on its axis, for any error in the diameters may be thus detected.

A few trials will, if he is careful, enable him to get a true line. If the observer has got the instrument level, he may now reverse and set up an object to the south; but in attaining the requisite degree of accuracy, he must reverse the transit on its bearings. It is apparent that if he has not taken his polar observation right, the instrument will be out of the line of the meridian; yet he must not despair, for on the succeeding night he may be able to get another observation in Polaris by which he may correct the first. The new beginner must not expect to get the line of his transit at first true with the meridian: so many slight errors exist, that even in the very best appointed observatories no little trouble is found in effecting this object. The sources of the errors are found in the difference of diameter of the pivots, in the want of firmness of the base, and inattention to careful adjustment of level, even after a true mark has been obtained; and never should an observation be taken without first adjusting to level; for, however firm the base may be, changes may occur from expansion or contraction, produced by changes of temperature.

Let it be assumed that the observer has succeeded in setting his instrument and getting the true meridian. We will next consider the objects to be observed, and herein is a difficulty; for if the instrument is not of high power, the only two bodies capable of being observed at night or in the day time are the sun and moon, the diameters of either rendering the observation liable to inaccuracy. Again, it is almost impossible to detect the instant that the limb touches a wire, and so the true centre is not found. In the case of the sun having been selected for a transit, the dark glass reduces the size of the image, and if the telescope is of low power the disc will be well defined, and for ordinary purposes the observation will be accurate enough, for the sharp outline can be detected at once as it touches the first wire; and as the transit has five wires, the mean of the whole number of contacts and departures will give the centre and the instant of its passage. It is not so easy to take a transit of the moon, for it is subject to two errors—the probable error, which must always be greater than the passage of a star; and a constant error, arising from the variations of the apparent semi-diameter. The outline of the moon's disc present several irregularities, and her revolution is attended with alternately greater or less distances from the primary: it will be obvious, then, that the apparent diameter of the disc will not be of the true apparent mensuration.

There is a mode of lunar observations, using the method of star culmination with the moon. While this astronomical method is recommended by its simplicity and the readiness with which the observation can be taken, it is somewhat doubtful, owing to the fact that the light is too intense in its effects on the retina; and, again, the agitation of the atmosphere, the two causes producing a swelling undulation in the apparent limb. To the inexperienced observer, this method would be too intricate to be of any service, we having only mentioned it as one of the modes of ascertaining longitude (time).

In the more refined astronomical operations of the present day, some one spot on the moon's surface is taken for the object, and if its latitude and longitude are known, it is a simple matter to take the observation, and reduce the centre by an easy calculation. It will be evident, however, that the instrument must be one of high power, and the adjustments as perfect as possible. The watchmaker will do better to rely entirely on the sun's passage, unless his transit is well illuminated, and at the same time of sufficient power to reveal a star, say at nine or ten o'clock in the morning. If he does possess such an instrument, he is perfectly independent of the sun's meridian, for he can take from the Ephemeris any star of sufficient magnitude, and by adding his westing or subtracting his easting know the instant it will pass the centre spider-line of his transit; now he can get, by careful comparison with his clock or chronometer, his true local time, and thus determine the rate of his timepiece.

If the transit is not equal to such performance, perhaps the best thing will be to rely entirely on the sun, being careful in every once in a while to verify his meridian by observations on the pole star; and these would also enable the observer to ascertain the error of his instrument and his own personal equation, for there are few who can observe equally; that is, the observer will be able at times to discern and note a star, or the edge of the sun, in the passage over the wires, much more readily than at other times.

TRANSPARENCY OF METALS.

That gold may be beaten to such a state of thinness as to readily transmit a greenish light, is a fact that has been long known; and this property has been used by the gold-beater as a practical test of the purity of the precious metal, inasmuch as the smallest admixture of silver with the latter causes a perceptible change of tint in the transmitted light. At a recent meeting of the New York Academy of Sciences there was exhibited a film of gold (mounted between two plates of glass for protection against injury) which was stated to be the thinnest "leaf" of this metal that had as yet been produced. The method by which this remarkable result was obtained was very simple, yet one that required considerable delicacy of manipulation. An exceedingly tenuous film of gold having been, by means of a galvanic battery, deposited on the surface of an ordinary daguerreotype plate of copper, the latter metal was afterwards dissolved away by the action of nitric acid, and the gold film caught on a plate of glass.

The property of translucency, when in thin films, has until a comparatively short time ago been regarded as one peculiar to gold alone; the reason being, perhaps, that but few metals besides gold can be successfully hammered to the necessary degree of tenuity. In this respect, indeed, no metals but silver and platinum have been found to approach to gold. The interesting discovery has been made, however, that by means of electricity thin films, not only of gold, but of the other metals, can be obtained which transmit light very readily. The method of obtaining these tenuous sheets of metal is by causing electric sparks to pass from wires of the required metals, passing into tubes of rarefied air or other gases, when the particles of metal, detached from the wires by the sparks, become deposited on the sides of the glass, forming an excessively thin film, quite continuous under the microscope. Of the metallic films thus produced gold transmits a fine green light; silver gives a fine blue colour; copper a dull green; platinum a bluish-grey; zinc a deep bluish-grey; iron, a tint nearly neutral, but inclining to brownish; and cadmium, like zinc, a bluish-grey.—*Scientific American.*

TURNERS' COMPANY'S PRIZE.

The Master, Wardens, and Court of Assistants of the Worshipful Company of Turners propose to give this year a silver medal, the freedom of the company, and, subject to the consent of the Court of Aldermen, the freedom of the City of London, for the best specimen of hand-turning in wood, and of diamond cutting and polishing. A bronze medal will be given as a second prize, and certificates of merit, as well as money prizes, will be awarded in the discretion of the judges. In the diamond cutting and polishing competition the Baroness Burdett Coutts has placed at the disposal of the Court £20, to be distributed among the competitors. A sum of £10 will also be awarded for the best specimen of amateur work in ornamental turning in either ivory or hard wood.

BOOK NOTICE.

Treatise on Modern Horology, in Theory and Practice. Translated from the French of Claudius Saunier. By Messrs. Julian Tripplin and Edward Rigg, M.A.

Part IV., now ready, contains:—*Cylinder Escapement.* Action of the escapement; proportions in vogue at different epochs; principle of the cylinder escapement; new theory of escapements with frictional rest; propositions summarising the new theory; resolution of forces in escapements; theoretical and experimental proof of the propositions advanced.

STANDARD RING SIZES.

Loss of time and money often result from the want of uniformity in ring gauges; so that Messrs. B. H. Joseph and Co., of 20, Frederick Street, Birmingham, have rendered the trade a material service by introducing their "Standard" Ring Sizes, which are made in steel dies and never differ in the slightest degree. They have supplied the principal manufacturers throughout the country with them, so that jewellers possessing a set of these gauges, by quoting the number and letter of the size they require, can order of the manufacturers with the certainty of avoiding any error. Another advantage they offer is, that instead of twenty-six sizes as heretofore, the Standard sizes are made with half sizes between, making fifty-two sizes altogether, by which greater accuracy is secured.

INLAND REVENUE PROSECUTIONS.

"Inland Revenue *v.* Pickford and Wright." (See April number of this Journal.) The decision in this case went against the defendants. Mr. De Rutzen stated that he could not discover any practical difference between the present case and that of "Young *v.* Cooke," and inflicted a fine of £12 10s. being one fourth of the full penalty. Defendants' solicitor asked for a case to a superior court, but the application was refused. The issue of this case is of the greatest importance to the trade, and united action is now necessary to bring about an alteration in the law.

THE PATENT REFORM BILL.

A Patent Reform Bill has been introduced into the House of Commons by Mr. George Anderson, one of the members for Glasgow, and contains some clauses which would prove beneficial to both present and future patentees. Under the existing law patents are granted for fourteen years, subject to the following payments—viz., £25 in four instalments within the first six months, £50 at the end of the third year, and £100 at the end of the seventh year. The new Bill provides that patents shall be granted for twenty-one years instead of fourteen, and at half the cost—viz., £12 10s. in four instalments within the first six months, £25 at the end of seven years, and £50 at the end of fourteen years. Under the existing law, patents are occasionally, in meritorious cases, prolonged by Her Majesty's Privy Council for periods of three to seven years beyond the fourteen, but the process is very expensive, costing in many cases from £200 to £300. Taking advantage of the principle already conceded, the new Bill makes provision for prolonging existing patents by the simple payment of a tax of £50 at the end of the fourteenth year.

CURIOSITIES OF CLOCKS AND WATCHES.

Continued from page 249.

At a meeting of the Archæological Institute held on March 1st, 1861, and also at a meeting of the Society of Antiquaries held on June 20th in the same year, Mr. O. Morgan exhibited a miniature clock in the form of a square tower surmounted by a dome, on which stood the figure of a boy playing on a lute. The height of the clock without the dome was only one inch and three-quarters. The case was of silver gilt, the works of steel. It went twelve hours, struck, and had an alarum. Mr. Morgan believed it to be of German work, and placed its date about the year 1600. It was the smallest standing clock he had ever met with. And at a meeting of the same Institute held on December 7th, 1855, the same gentleman exhibited two clocks of novel design and construction. One was in form of a griffin, bearing an escutcheon, on which was the dial; the animal constantly rolled its eyes whilst the mechanism was in movement, and it opened its mouth when the quarters struck, and flapped its wings at the striking of the hour. The other was in the form of a crucifix; the hours were shown on a globe, which revolved on the top of the cross. The date of these strangely shaped clocks was the early part of the seventeenth century. In the South Kensington Museum is another clock arranged as a crucifix. It is of ebony, silver, and gilt, and enamelled bronze. It is of French or Flemish manufacture, of the seventeenth century. Its height is fourteen inches and a half.

The Hon. W. B. Warren Vernon has a clock of gilt metal in the form of a turret, with a pinnacle top, upon a stand of ebony; it has chased silver ornaments, and is of the seventeenth century, and of French manufacture. In the South Kensington Museum is a medallion clock, in a rock crystal case, supported on a baluster-shaped crystal stem; it is dated 1609; its height is seven inches and three-quarters, and it was purchased at the Bernal sale for £14. Mr. A. J. B. Beresford-Hope has a gilt metal clock with columns and pinnacles at the angles, engraved dial, and square *repoussé* stand; it was made at Strasburg in 1614; also a gilt metal table-clock of hexagonal shape, with glass panels, resting on six terminal figures; it is of the seventeenth century.

In 1605 a clock was put up in the cathedral at Frankfort. It consisted of three parts or divisions. In the lowest, which looked like a calendar, were several circles, the first of which showed the days and months, the second the golden number, with the age and change of the moon, and the third the dominical letter. The fourth and fifth circles represented the ancient Roman calendar. On the sixth were the names of the apostles and martyrs, the length of the days and nights, and the entrance of the sun into the twelve signs of the zodiac. The seventh and eighth circles exhibited the hours and minutes when the sun rose and set. In another circle the divisions of the twelve signs of the zodiac, the four seasons, and the twelve months were marked. A circle in the centre showed the movable feasts. The figures which struck the hours represented two smiths with hammers in their hands. This piece of mechanism was repaired for the first time in 1704.

In Jevons' "Issues of the Exchequer," the Pell Records of the time of James I., we find the following entries:—1605, 10th October. "By order, the last of September, 1605. To Uldrich Henche, clockmaker, or to his assignee, the sum of £100 for a clock, in manner of a branch, made by him, and set up in his Highness's chamber at Whitehall. By writ dated 23rd of July, 1605. £100." 1607, 5th July. "To Humphrey Flood, goldsmith, or his assigns, the "sum of £120, in full satisfaction and payment for a clock covered with gold, and set with diamonds and rubies, and by him delivered to his Majesty's use, at the price of £220, whereof received £100. By a Privy Seal, dated the 5th of July, 1607. £120." 1617, 1st April. "By order, dated 29th of March, 1617. To Ranulph Bull, keeper of his Majesty's great clock, in his Majesty's palace of Westminster, the sum of £56 13s. 4d., in full satisfaction and discharge of and for divers sums by him disbursed for mending the said clock, in taking the same and other quarter clocks all in pieces, and repairing the same in the wheels, pulleys, hammers, weights, and in all other parts, and in new hanging, wiring, and cording of the same clocks, and other necessary reparations thereunto belonging, the charge whereof, with his own workmanship and travail therein, doth amount to the sum aforesaid, appearing by a note of the particular demands, delivered upon his oath, taken before one of the barons of his Majesty's Exchequer, without account or imprest made thereof. By writ, dated 27th of March, 1617. £56 13s. 4d." It will be observed that the last payment was made to Ranulph Bull. We find in an account of the household expenses of Prince Henry, in 1610, Emanuel Bull, the "clock-keeper," mentioned; probably he was some relation of the clock-keeper of James I., if not the same identical person.

In the collection of State Papers of the year 1622, in the same king's reign, there is a warrant to pay £232 15s. to David Ramsey, the king's clockmaker, for repairing clocks at Theobalds, Oatlands, and Westminster, and for making a chime of bells adjoining to the clock at Theobalds. On the accession of Charles I., Ramsey was again appointed the king's clockmaker, and was also nominated the first master of the Clockmakers' Company in the charter of incorporation in 1631. It would seem that foreign artisans were at this period extensively employed in clockmaking in England; and it appears from documents which are now in the State Paper Office, that early in the seventeenth century there were in London fifteen clockmakers and two watchmakers, all of whom were foreigners. In 1622 the clockmakers of London complained to James I. of the great number and deceitful tricks of foreigners practising their trade, and begging that they might not be permitted to work except under English masters, and that no foreign clocks might be imported. In 1631 the Clockmakers' Company of London was incorporated by a royal charter, dated August 22nd in that year, from Charles I., as "The Master, Wardens, and Fellowship of the Art of Clockmakers of the City of London." The company had power by their charter to make byelaws for the government of all persons using the trade in London or within ten miles thereof, and for the regulation of the manner in which the trade should be carried on throughout the realm; and in order to prevent the public from being injured by persons "making, buying, selling, transporting, and importing any bad, deceitful, or insufficient clocks, watches, alarums, sundials, boxes, or cases for the said trade," powers were given to the company by the charter "to enter with a constable or other officer any ships, vessels, warehouses, shops, or other places where they shall suspect such bad and deceitful works to be made or kept, for the purpose of searching for them;" and if entrance should be denied, they might effect it by force. This right of search was constantly exercised until the end of the century. The town was divided into districts, periodical searches were made, and many instances are recorded of deceitful works being found and broken up.

(*To be continued.*)

A new calculating machine has been invented by a watchmaker in Michigan. It contains 2,100 distinct pieces, and if vices and rivets are included over 3,000. It executes in a single operation a multiplication or division of twelve figures, a subtraction, etc., with perfect accuracy. To the question, "What is the compound interest of 5,630 dollars 75 cents for 20 years at 7 per cent.?" the machine answered in 45 seconds, "16,158 dollars 47 cents."

CORRESPONDENCE.

It must be distinctly understood that we do not necessarily identify ourselves with the opinions or views of any of our Correspondents. Our pages are alike open to all for free discussion of questions connected with the various trades which we represent, and all Correspondents will find every opportunity afforded them for expressing their opinions.

HALL-MARKING AND DUTY QUESTION.

To the Editor of the Watchmaker, Jeweller, & Silversmith.

Sir,—The members of the silver trade generally thought so little of what they termed Mr. Watherston's nonsense, that it required some effort to induce them to believe that any possible notice could be taken of it; forgetting that the public having no technical knowledge on the subject could be easily deceived. But the sound of "12,777 *suffering silversmiths*" bore with it such weight that even many of the public papers have committed themselves to Mr. Watherston's views. I have in my pamphlet pointed out some of the inaccuracies adduced, and now wish to have a word or two to say respecting Mr. Watherston's letter in your Journal of May 4th.

Mr. Watherston says that what I have written is "from the stand-point of a manufacturer," and vaunts himself a champion of the "thousands of retail dealers." Now I would like to know who the "thousands of retail dealers" are who endorse Mr. Watherton's views, or indeed where a single hundred are to be found who would thank him for this much-ado-about-nothing. It is very easy for a man to say that he speaks in the name of any number of his fellow-men, but unless he speaks the opinions of those whom he professes to represent, his position as a representative is a self-constituted one, utterly worthless and even ridiculous. Now I venture to assert that such is Mr. Watherston's position when he claims to speak on behalf of 12,777 retail silversmiths, for but a fractional part of them are in agreement with him upon this subject. I have taken the trouble to inquire of the trade in most of the provincial towns of importance from Yorkshire to the South of Devon, and have only found one firm (and that I believe a friend of Mr. Watherston's, in Manchester) who held with him; all others being decidedly opposed to the uncalled for interference.

While Mr. Watherston is making a great cry about Free Trade, he is in reality opposing it.

I have neither taken a manufacturer's stand-point *as opposed* to a dealer's, nor that of a Protectionist *against* Free Trade. It may suit Mr. Watherston's purpose to make it appear so, but perversion is not truth, and will only show more glaringly when exposed. Free Trade I fully advocate, if it be *honest*. Let foreign-manufactured silver goods be brought into the country by any who can sell them, if in so doing the English public are not cheated. If excellence of manufacture be the test, let all compete: fair emulation will only tend to the prosperity of the trade. But for one maker (foreign or English) to be allowed to use a material of less than half the value compulsory upon others, is not only unjust, but fraudulent; and if Mr. Watherston's views are correct as to the desirability of leaving the quality an open question, will he tell us why it has of late years been found necessary to legislate respecting adulteration? Why not allow the grocer to put as much chicory into his coffee as he pleases? or the baker and provision merchant to reduce the quality of his goods to his *own* standard? Why be so hard on the milkman because he has not kept his milk up to standard? If Mr. Watherston be right, the Government has been doing wrong in appointing public assayers in every place to keep dealers in drugs, articles of diet, etc., honest; but silversmiths are more honest, and can stand on their own respectability. This may sound very well as a hypothesis, but in truth there is no trade in which fraud could be more easily perpetrated than the silver trade, if a stringent surveillance were not kept. Mr. Watherston says, remove this surveillance and give us all a chance. No, no, Mr. Watherston; the Utopian age has not arrived in which we can leave our wharehouses and shops open night and day, and trust to the honesty of our neighbours. Why does Mr. Watherston so carefully secure his valubles in strong safes every night? Why not let the thieves have a chance? Mr. Watherston takes care to protect himself from such, and that is the only kind of protection we ask for ourselves and the public.

Let me ask *who* would be benefited by the alteration? Not the public, for they would be exposed to fraud without the means of detecting it. Much as they are now swindled by the vast amount of electro-plate rubbish thrown on the market, it is nothing to what makers of silver pate could and would be capable of, if *compulsory* marking were done away with. Is it the "retail thousands" who would be benefited? I have statistics to prove that at least they do not think so, and I quite agree with Mr. Watherston in his statement, that they do not "possess an imperfect knowledge of their trade." Is it then the manufacturers? Not the honest ones, but fraudulent ones would spring up in abundance, whose only aim would be to cheat the public with their wares. Such would flourish, and those "retail dealers" whose "*interest it is to sell anything of any quality . . . . to any customer whom they may be able to find willing to purchase.*"

In reference to the last clause of Mr. Watherston's letter, I will, according to his wish, quote from some of the early Acts of Parliament.

Statute 5, *Henry IV.*, 13.

> "Item.—Whereas many fraudulent artificers imagining to deceive the common people, do daily make . . . . and the same sell and put in gage to many men not having full knowledge thereof for whole gold and whole silver to the great deceit, loss, and hindrance of the common people . . . . It is ordained, etc., etc."

Statute 18, *Eliazbeth* 15, *says—*

> "Whereas certain evil disposed goldsmiths deceitfully do make and sell plate, and other gold and silver wares, to the great defrauding of Her Majesty and her good subjects: for remedy thereof, Be it enacted, etc."

Confimation of Goldsmiths' Charter, 2nd year of King James.

> "And that now of late the said merchants, as well private as strangers, do bring from foreign countries into this nation counterfeit sterling, whereof the pound is not worth above sixteen sols of the right sterling; and of this money none can know the true value but by melting it down."

I might quote from more, but the above are sufficient to show that even when the Goldsmiths' Company exercised powers far beyond what it does in the present day, fraudulent makers and dealers were guilty of swindling the public at every available opportunity, and that successive Acts of Parliament had to be passed in order to stop such fraud.

When the duty was imposed, it became the work of the Government as well as the Guild to look after and punish evil-doers; and it is this combined power that has kept the quality of our standard up to its present state. Surely it cannot be pleaded that less vigilance is needed now.

I am, Sir, your obedient servant,

Bristol, May, 1878. JOSIAH WILLIAMS.

Prices Current for Gold and Silver.—Value Given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver, 4s. 6½d. to 4s. 9d. (variable according to quantity).

GOLDSMITH'S WORK OF THE ANCIENTS.

By the Author of "Antique Gems."

Of the most ancient goldsmith's work on record, that masterpiece of the Olympian jeweller, the necklace wedding gift of Venus to Harmonia, the mystic Nonnus has left penned the following elaborate description (Dionysius, v. 173) :—

"With cunning hand the god a necklace wrought,
And to a serpent's form his labour brought;
In full relief, embossed in living gold,
Her double head an amphisbæna rolled,
And spurting venom from each twofold jaw,
Seemed either way her tortuous folds to draw;
Whilst head with head aye striving to conjoin
She writhes in many a coil her body's starry twine;
Thus like the twofold neck, encircling round,
Its wavy back the artful collar wound.
Horrent with scales was seen each separate snake
Down to the navel; thence but one they make:
For at the hinge, so cared the smith divine,
In one huge ring is tied the weighty spine.
So glancing sideways with each quivering head
She seems to vomit out her hisses dread.
But where each mouth begins and where each ends,
Modelled in gold erect an eagle stands,
As clearing the wide heaven himself he draws
From out the compass of the dragon jaws;
On pinions *four*, conspicuous on high,
With wings quadruple doth he mount the sky.
On *one* a jasper gleams with orange bright,
On *one* a moonstone of a matchless white—
The gem that wanes whene'er the horned queen
With wasting orb above the heavens is seen,
But wanes still whene'er the moon renewed
Pours from her horn the liquid silvery flood—
Whilst the pale goddess from the sun, her sire,
Draws in like milk the self-begotten fire—
Casts from the *third* the dawn-like pearl its rays
Whose charm the Red Sea's boiling surge allays;
Whilst on the *fourth*, of round and bossy form,
An Indian agate pours its lustre warm.
But where the viper heads together bend,
Full wide their jaws the gaping mouths extend,
As though with ravening fangs they eager strove,
Caught in the midst, to seize the bird of Jove.
From either head, set 'neath each threatening brow,
Their lamp-like flame fierce burning rubies throw,—
Mimicked in various stones there ocean spreads,
O'er which its hue the sea-green emerald sheds,
Which joined to a crystal in one common home
Pictures the darkening brine, the wave-tossed, bubbly foam.
Wrought on its face disport in golden sheen
The sea-born flocks that rove the depths marine;
Where many a plougher of the watery way,
The bounding dolphin cuts the topmost spray,
And in the midst where his companions sail
With life-like frolic curves his lashing tail.
There too of birds the parti-coloured choir
With flapping wings in semblance strike the ear.
Such was the gift whose curious art outvied
Its gold and gems in all their priceless pride,
That Cythereia, the young bride to deck,
Midst the glad rites clasped round her virgin neck."

This picture is not a mere figment of the poet's fancy, but a paraphrase of some account, then extant, of a celebrated relic that was preserved far down into historic times. As the fatal bribe of Eriphyle it had been dedicated at Delphi by the avenger, Alcmæon; but its fame and beauty saved it from the melting-pot, to which the necessity of the Phocian chief consigned all the other donaria of previous ages. From the possession of the tyrant's wife it doubtless passed undamaged into the conqueror's hands, and was, as the nature of the case demands, restored to its original shrine. The authenticity of the details in Nonnus appear from several considerations. Firstly, from his minuteness in this particular point, whilst he passes over all the other components of the bridal *trousseau* in the most vague and cursory terms. Secondly, from the very confusedness of his account, for he is evidently putting into verse a technical and detailed description, the terms of which he was himself far from comprehending. Again, the entire character of the jewel, minutely correct if regarded as an archaic work, is totally diverse from that of the decorative art of the Lower Empire, and such as no poet of these times could possibly have devised by his unassisted imagination. Its whole design is Assyrian, for by extracting the sense of the flowery and intricate verses above cited, we discover its form to have been a *torques*, shaped like a double-headed serpent (precisely that seen in the neck of Darius in the Pompeian mosaic); the centre ornament was an eagle having *four* wings, adjuncts unknown to Greek art, but typical of Assyrian—it was the Babylonian Tynx, the Hebrew Cherub—each wing set with a different gem: a jasper, a moonstone, an Indian agate, a pearl; having also a pendant composed of an emerald and a crystal surrounded by a framework of fishes and birds; the eyes of the serpents were of *lychnis*—*i.e.*, spinels. The choice of these gems attests again the antiquity of the work, the agate and jasper ranking with the pearl and the ruby. A poet of the fourth century would have thought scorn of these then so vulgar gems, and would, like one of our day, have substituted for them the diamond and the opal, especially in the reputed handiwork of a god.

All the magnificent works in which the artist goldsmiths of Asia, Greece, and Rome displayed their wondrous taste and skill have utterly perished. Of their magnificence we can form but an inadequate idea from the descriptions of history, but of their excellence in point of art, the personal decorations, though of small intrinsic value yielded to modern research by the Greek and Etruscan tombs suffice to give us an example. The sole relic that has escaped the barbarian despoiler of the lavish splendour of Imperial Rome is the Patère de Rennes, now enriching the Bibliothèque Impériale. In form it is a shallow bowl, ten inches in diameter, and weighing about forty ounces troy. In the centre, in an emblema, a spirited composition, the renowned drinking-match between Hercules and Bacchus, containing eight figures—the two gods, the attendant fauns, and a panther. It is surrounded by a frieze, exhibiting in low relief the triumph of the jolly god over his competitor, into which enter twenty-nine figures and five animals—elephants, panthers, goats. The broad exterior rim is adorned with equidistant garlands of acanthus and laurel alternately, in which are set eighteen aurei, ranging from Hadrian down to Geta inclusive; that is, of all the princes of the surname Antonini. This precious relic was found at Rennes (1777) in clearing away the foundation of an old house. It had been deposited in a vault together with a hoard of coins dating from Nero downwards; and what is of special interest as marking the date and perhaps the occasion of its concealment, a necklace made out of aurei of the usurper Postumus set in frames of pierced work.

There exist, however, three monuments which exhibit the Roman art, though in its most degraded state; and these both for their rarity and their historical interest are well deserving of a particular description. They therefore shall be taken in chronological order, and we begin with the

HISPANO-GOTHIC CROWNS.

In the year 1858 some labourers employed in bringing under cultivation the site of a deserted cemetery at Fuente di Guerrazzar, two leagues from Toledo, came upon a buried treasure, consisting of eight crowns and coronets in gold adorned with gems, the intrinsic value of which is calculated at £2,000. The whole treasure-trove quickly found its way to Paris, were it was without any needless delay (or reference to ignorant trustees), secured by the proper authorities for the Musée de Cluny, of which it now forms the most interesting feature, being ingeniously displayed to public inspection within a glass case, accessible on every side.

(To be continued.)

TRADE RECIPES, &c.

Metal for Medals.—50 parts copper, 4 zinc.

Bronze Metal.—Copper 7 lbs., zinc, 3 lbs., tin 2 lbs. Another: Copper 1 lb., zinc 12 lbs., tin 8 lbs.

Alloy for Bells of Clocks.—The bells of the French ornamental clocks are composed of copper 72·00, tin 26·56, iron 1·44 in 100 parts.

Black Enamel—Pure clay 3 parts, protoxid of iron 1 part. A fine black.—*Clouet.*

Silvering Powder for Coating Copper.—Nitrate of silver 30 grains, common salt 30, cream of tartar 3½ drams. Mix, moisten with water, and apply.

To Tighten a Ruby Pin.—Set the ruby pin in asphaltum varnish. It will become hard in a few minutes, and be much firmer and better than gum shellac, as generally used.

Silvering Powder.—Take 40 grains of silver dust, cream of tartar 3 drams, common salt 2, and 40 grains of powder of alum. Polish any silver articles with this powder and a soft leather.

Yellow Enamel.—Pure oxide of silver added to the metallic fluxes. The salts of silver are also used, but are more difficult to manage. If a thin film of oxide of silver be spread over the surface of the enamel to be coloured, exposed to a moderate heat, then withdrawn, and the film of reduced silver on the surface removed, the part under will be found tinged of a fine yellow.—*Clouet.*

To Temper Brass or to Draw its Temper.—Brass is rendered hard by hammering or rolling; therefore, when you make a thing of brass necessary to be in temper, you must prepare the material before shaping the article. Temper may be drawn from brass by heating it to a cherry red, and then simply plunging it into water, the same as though you were going to temper steel.

Frits or White Flux.—The basis of all enamels is a highly transparent and fusible glass, called frit, flux, or paste, which readily receives a colour in the addition of metallic oxides. There are numerous formulæ for its preparation, as red lead 16 parts, calcined borax 3 parts, powdered flint glass 12 parts, powdered flints 4 parts, fuse in a Hessian crucible for twelve hours, then pour it out into water, and reduce it to a powder in a biscuit-ware mortar.

Ormolu.—The ormolu of the brass founder, popularly known as an imitation of red gold, is extensively used by the French workmen in metals. It is composed of a greater portion of copper and less zinc than ordinary brass, is cleaned readily by means of acid, and is burnished with facility. To give this material the rich appearance, it is not unfrequently brightened up after "dippings" by means of the scratch-brush. It is protected from tarnish by the application of lacquer.

To Make Oreide Gold.—Oreide gold is figuring no little at this time in the way of cheap jewellery. The best article is made by compounding four parts pure copper, one-and-three-fourth parts pure zinc, one-fourth part magnesia, one-tenth part salammoniac, one-twelfth part quick-lime, and one part cream tartar. Melt the copper first, then add as rapidly as possible the other articles in the order named.

To Blue Screws Evenly.—Take an old watch barrel and drill as many holes into the head of it as you desire to blue screws at a time. Fill it about one-fourth full of brass or iron filings, put in the head, and then fit a wire, long enough to bend over for a handle, into the arbor holes, head of the barrel upwards. Brighten the heads of your screws, set them, point downwards, into the holes already drilled, and expose the bottom of the barrel to your lamp till the screws assume the colour you wish.

Restoring the Colour to Ivory.—Ivory is very apt to take a yellow-brown tint by exposure to air. It may be whitened or bleached by rubbing it first with pounded pumise-stone and water, then placing it moist under a glass shade luted to the sole at the bottom, and exposing it to sunshine. The sunbeams without the shade would be apt to occasion fissures in the ivory. The moist rubbing and exposure may be repeated several times. Another method is to immerse for a short time in water slightly mixed with sulphuric acid, chloride of lime, or chlorine, or it may be exposed in the moist state to the fumes of burning sulphur, largely diluted with air. Ink stains may be removed by repeatedly using a solution of quadrozalate of potassa in water.

To Change Depth of Lever Escapement.—If operating on a fine watch, the best plan is to put a new staff into the lever, cutting its pivots a little to one side just as far as you desire to change the escapement. Common watches will not, of course, justify so much trouble. The usual process in their case is to knock out the staff, and with a small file cut the whole oblong in a direction opposite to that in which you desire to move your pallets, then replace the staff, wedge it to the required position, and secure by soft soldering. In instances where the staff is put in with a screw, you will have to proceed differently. Take out the staff, prize the pallets from the lever, file the pin-holes to slant in the direction you would move the pallets, without changing their size on the other side of the lever. Connect the pieces as they were before, and with the lever resting on some solid substance, you may strike lightly with your hammer until the bending of the pins will allow the pallets to pass into position.

Cleaning and Repairing American Clocks.—Take the movement of the clock to pieces. Brush the wheels and pinions thoroughly with a stiff coarse brush, also the plates into which the trains work. Clean the pivots by turning in a piece of cotton cloth held tightly between your thumb and finger. The pivot holes in the plates are generally cleansed by a strip of cloth or a soft cord drawn tightly through them. If you use two cords, the first one slightly oiled, and the next dry to clean the oil out, all the better.

To Bush.—The holes through which the great arbors or winding axles work are the only ones that usually require bushing. When they have become too much worn, the great wheel on the axle before named strikes too deeply into the pinions above it, and stops the clock. To remedy this, "bushing" is necessary. The most common way of doing it is to drive a steel point or punch into the plate just above the axle hole, thus forcing the brass downward until the hole is reduced to its original size.

To Remedy Worn Pinions.—Turn the leaves or rollers so that the worn places upon them will be towards the arbor or shaft, and fasten them in that position. If they are rolling pinions, and you cannot secure them otherwise, you had better do it with a little soft solder.

To Oil Properly.—Oil only, and very lightly, the pallets of the verge, the steel pin upon which the verge works, and the point where the loop of the verge wire works over the pendulum wire. Use none but the best watch oil.

To Make it Strike Correctly.—If not very cautious in putting up your clock, you will get some of the striking train wheels in wrong, and thus produce a derangement in the striking. If this should happen, pry the plates apart on the striking side, slip the pivots of the upper wheels out, and having disconnected them from the train, turn them part around, and put them back. If still not right, repeat the experiment. A few efforts at most will get them to working properly.

A Defect to Look After.—Always examine the pendulum wire at the point where the loop of the verge wire works over it. You will generally find a small notch, or at least a rough place, worn there. Dress it out perfectly smooth, or your clock will not be likely to work well. Small as this defect may seem, it stops a large number of clocks.—*F. Kemlo.*

HARDENING AND TEMPERING STEEL TOOLS.

SKILL and judgment in the manipulation of steel are qualities of which the expert workman may well be proud; yet there is nothing so difficult about it but that by patience any one of common abilities may become the possessor of it. The forging of steel tools requires great care, and for delicate instruments that are to be nicely tempered too great care on the part of the workman cannot be exercised. The quality of the steel ought to be attended to, particularly for dies or cutting tools. Of this you can judge in a great measure by the fracture. Break the bar you wish to work. If the piece presents a clear, bright cleavage that shows as if it had taken some force to separate it, the separate crystals or granulations scarcely observable, and the appearance that of a fine, light, slaty-grey tint, almost without lustre, it may be considered to be good.

After the tool or article that is to be tempered is finished up by the mechanic, it is to be hardened. To the inexperienced it appears to be a simple operation, and one that any one could easily perform, consisting in nothing more than heating it, and suddenly quenching the heat in cold water. A very simple process surely; then why so much ado about it? Surely the greenest apprentice can do it. So he might; but, perhaps, when the said apprentice takes the tool from the water in which it has been chilled, it is warped, cracked, and entirely spoiled. The once nice tool is now only fit to be thrown in the scrap-pile. Surely, after all, it does require some experience and judgment to temper steel. We will give a few hints that may not be wholly lost to the less experienced who aspire to success in this art.

The water that you use must not be too cold. The heat should never exceed a low red. The reason why the water should not be too cold is this: The water acts too suddenly on the outside of the steel, contracting it, and the expansion in the middle being more than the outside can bear, it causes the hardened and brittle covering to break. If the water is too cold throw a few coals into it, or plunge a bar of hot iron into it, and take the chill off the water. When this is done, look well to the heating of the article. Heat it quite slowly and very evenly, and, when it is ready to harden, if there is a thick and thin part, plunge the thickest part into the water first, and be careful to plunge it in the centre of the vessel of water, so that the heat of the article will warm it equally on every side; if not, the unequal warmth may cause the article to warp. A worse thing will happen if the thin edge be put in first, for if the thick part has to contract after the thin part is chilled, the thin part cannot give, and will be consequently broken. By chilling a piece of steel, and lifting it from the water before it is entirely cold, will produce the same effect. The outside being hardened, and the inside quite hot, it begins to expand when taken from the water, and the breaking of the chilled surface is the result. In dipping articles in water one part of which requires to be left soft, it often happens that it breaks where the water-line comes on the article. This is caused by the contraction of the portion in the water, while that above the water is not contracted in the same proportion. To remedy this, move the article up and down a little, so that the water-line shall not be at a stationary point. This will be particularly applicable to tempering points of drills and chisels. Water that holds soap in solution is unfit to temper with. The water should be clean and pure. To ensure a greater hardness, common salt may be added to the water, so as to form a saline solution. Gauges and burnishers that require to be very hard can be tempered to advantage in this solution.

Scarcely an operation in mechanics is performed with greater hazard than that of hardening and tempering tools; for, if the operator is unskilful, the whole labour of forging and finishing the tool, together with the value of the steel employed, is in an instant wholly destroyed and lost, and nothing avails but to perform again the labour, and produce another tool. The dangers to which steel is liable in the process of hardening are warping and cracking. The first may be caused by unequal density in forging, one portion of the steel being more compressed than another by the hammer-blows, and unequal contraction ensues when the hardening takes place, which causes the article to warp and twist. Another cause of warping is when the thick and thin portions of the metal are so proportioned that in the shrinkage the thinner portion is forced to one side, or pulled away, as it were, from its proper place; and this may take place to such an extent as to cause the article to crack in a greater or less degree. Too high a heat or too great coldness of the bath in which the articles are hardened, may produce these results. As a remedy for warping from unequal forging, care must be exercised by the operator, or steel may be used which has been formed by rolling, or by means of the drop and die. As an instance to verify the truth of the assertion that rolled or drawn steel seldom warps, we may mention the twist drill as made from steel wire. The density of the metal being homogeneous in all parts, it seldom warps or springs in hardening. Where an article is made with thick and thin portions, the best remedy is skill and judgment. The thick part must be chilled, or come in contact with the water first, and by its first contracting it cannot bind upon the thin part, so as to cause it to give way. It is difficult to give precise directions for such operations, and the best suggestion is that the person intrusted with such tools to harden should be possessed of judgment and experience in these operations, and have a knowledge of the nature of the material with which he is dealing. Even in placing tools which have unequal proportions in the fire, a springing or warping may be produced by one portion expanding more than another, and as much care is necessary for heating of tools as for the hardening.

With the successful hardening of tools or other articles we may consider that the greatest danger of destruction is passed, and all that now remains is to reduce this hardness to the proper degree, or draw the temper, as it is technically termed. Between the extreme conditions of hardened and soft steel there are many intermediate grades, the index of which is oxydation or colouring of the brightened surface when heat is applied.

The brightening of the surface is accomplished in many ways. A piece of sandstone or grindstone, or even a fragment of brick, is sometimes employed. The buff-stick, which consists of a piece of wood shaped like a file, and covered generally with leather, but often not, and the surface coated with glue and emery, the glue holding the emery in place, is another means often used; but the best of all is the polish-wheel, where a sufficient number of articles or the nicety of the work will warrant of such a procedure in its use. The tints or colours are produced upon the polished surface by the application of heat, and the respective approximate temperatures may be represented thus:—

1.—430	degrees	Fahr.	very pale straw yellow.
2.—450	,,	,,	a darker shade of yellow.
3.—470	,,	,,	darker straw colour.
4.—490	,,	,,	still darker straw colour.
5.—500	,,	,,	brown yellow.
6.—520	,,	,,	yellow, tinged with purple.
7.—530	,,	,,	light purple.
8.—550	,,	,,	dark purple.
9.—570	,,	,,	dark blue.
10.—590	,,	,,	pale blue.
11.—610	,,	,,	still paler blue.
12.—630	,,	,,	paler blue, with tinges of green.

The tempering colours differ slightly with different qualities of steel, some kinds of which require a higher degree of temper or colour than others to obtain the same degree of hardness, but a knowledge of this can only be obtained by actual experiment. In the tables given, Nos. 1 and 2 are used for tools to cut metals; 3 and 4 are used for the same purpose where more elasticity is required; 5, 6, and 7 are used for tools employed in cutting wood; 8 and 9 for springs; and 10, 11 and 12 are too soft for any of the mentioned purposes. Many mechanics employ colours or tempers a degree or two lower than these mentioned, and use a sort of general colour for certain kinds of tools, making an average as to colour and quality of steel; but with the mechanic who is at all fastidious about the temper of his tools, or where a very particular temper is required, as in gravers, chasers, &c., the quality of the steel must be taken into consideration, and the hardening and tempering intrusted to none except the most expert in such operations.

PEARL INLAYING.

Cast and sheet iron and papier-mâché are the materials upon which pearl is generally inlaid. If the article be of cast iron, it is well cleaned from the sand which usually adheres to the casting, and is blackened with a coat of varnish and lamp-black. When this is thoroughly dried, a coat of japan or black varnish is spread evenly upon it. Before the varnish becomes too dry, pieces of pearl cut in the form of leaves, roses, or such flowers as the fancy of the artist may dictate, or the character of the article may require; are laid upon the varnish, and pressed down with the finger, and they immediately adhere to the varnished surface. The work is then placed in a heated oven and kept there for several hours, or until the varnish is perfectly dried. It is then taken from the oven and another coat of varnish applied indiscriminately on the surface of the pearl and the previous coating, and again placed on the oven till dry. This process is repeated several times. The varnish is then scraped off the pearl with a knife, and the surface of pearl and the varnish around it are found to be quite even. The pearl is then polished with a piece of pumice-stone and water, and the surface of the varnish is rubbed smooth with powdered pumice-stone, moistened with water.

It is in this unfinished state that the pearl has the appearance of being inlaid, and from which it derives its name. Its final beauty and finish depends altogether on the skill of the artist under whose hands the shapeless and almost unmeaning pieces of pearl are made to assume the form of beautiful flowers, leaves, etc. The artist traces the stems and leaves of the flowers with a camel's-hair pencil, dipped in a size made of varnish and turpentine: upon this he lays gold leaf, which adheres where there is size, and the superfluous gold is carefully brushed off with a piece of silk. The flowers and leaves are then painted in colours, and when dry the picture and surface of the article are covered with a coat of refined white varnish.

The kinds of pearl used are three: mother of pearl, in the pearl oyster, or white pearl, as it is called by the artist, and it is known by its clear white surface; aurora shell, which can readily be told by its wrinkled appearance and its various prismatic colours, and is made from the shell of the genus of mollusca known as the sear-ear or ear-shell, and known to the conchologist as haliotis; the green snail shell, which can be told by its glistening colours of light dark green, or soft yellow and a bright and beautiful pink, blended together.

To manufacture the pearl ready for inlaying, the workman cuts the rough shells in pieces with saws and then grinds the pieces upon both sides upon a common grindstone until they are of the requisite thinness. Out of these pieces the artist cuts the forms of leaves, flowers, etc., with a pair of common scissors preparatory to placing them in the varnished surface. The necessary forms may be cut from the thin pieces of pearl by means of a punch and dies, with power applied by the foot of the operator. When a number of pieces are required of the same size, the pieces may be fastened together with glue as one solid plate, and then the required form marked upon the outside one; then these being held in a vice, the form can be carefully sawed out with a fine saw. By placing the cemented pieces in warm water, the glue softens, and the shells are easily separated and the glue washed off.

This art of inlaying is not confined to the representations of flowers alone: landscapes with houses, castles, trees, churches, and bridges are very easily made, and when represented as being seen by moonlight are very beautiful. The rising moon can be represented surrounded by clouds of gold and silver bronze, and when pieces of pearl are placed in certain positions to reflect their colours, the moonbeams are represented as glancing over the landscape in alternate light and shadow.

A varnished surface can be ornamented by transferring drawings or engravings to it, and the process is quite simple. A thin coat of copal varnish is spread upon the surface of the article, and when nearly dry the engraving is applied with its face downward and carefully pressed to exclude all air bubbles. When the varnish is sufficiently dry, the paper is thoroughly moistened with a sponge dipped in warm water, and the paper can be rubbed off, leaving all the lines of the print upon the varnished surface.

BUNYAN SHIELD.

Messrs. Elkington & Co., of Birmingham, exhibit a beautiful work of art in the shape of a shield, called the "Bunyan." It is the result of over two years' diligent labour, by M. Morel-Ladeuil, the artist by whom the "Milton" shield, now at South Kensington, was produced, and who is also well-known by many other specimens of *repousée* work of the highest order. The "Bunyan" shield is the same size as the "Milton," and consists, like the latter, of five plates or medallions of beaten silver mounted in iron; but the shape of the plates is different from that of those in the "Milton" shield. The central plate represents the "Combat between Christian and Apollyon;" and the time selected by the artist is when Christian is delivering his final blow, which secured to him the victory over his adversary. The faces of both the combatants are in the highest degree vigorous and expressive; and the accessories of the scene, the attendant fiends and angels, are introduced with great skill and judgment. At the feet of Christian is the helmet, which he lost early in the encounter; and he is repelling the last of Apollyon's darts with the shield of faith, while his right hand swings back the sword of the spirit in a pose which is full of life and earnestness. Immediately beneath this medallion, in the iron, is a figure of John Bunyan, sleeping, and much refined upon the actual representations of the worthy cobbler. The two lower medallions exhibit the "Valley of the Shadow of Death," thronged with shapes hideous and horrible, among which the narrow road is seen winding; while the upper medallions represent the "Road to the Celestial City," passing through the "glorious company of seraphim and cherubim, the elders with their golden crowns, and the virgins with their harps." Beneath the silver bas-reliefs, and in the iron work, are escutcheons bearing devices emblematical of the three Christian virtues—Faith, Hope, and Charity. The surfaces of iron between the medallions are further embellished with appropriate arabesques, here and there enriched by gold inlaying; but the general effect is somewhat more severe than that of the "Milton" shield, as befits the different character of the subject. The hammer work, taking it as a whole, is of extraordinary excellence, and the relief in some parts is wonderfully high and sharp, as, for example, in the wings of Apollyon and in the sword of Christian.

The net yield of gold for the colony of Victoria last year, according to calculations of the Melbourne *Argus*, is 792,839 ozs., showing a decrease on the previous year of 144,421 ozs.

SILVER WORK IN THE UNITED STATES.

By Edwin C. Taylor.*

THE useful arts, by which I mean those industries into which the expression of beauty enters as a subordinate and not as an essential element, have advanced further in the last decade of years than in the half-century immediately preceding.

In no field of industrial art is the improvement more marked than in the artistic and ornamental use of silver, and the fact that the yield of that metal in our own country alone is likely for many years to be vastly in excess of the natural demand, tends to encourage its more abundant use in the arts where it can be employed. The vast surplus over the necessities for coinage had far better be diverted to the uses of art than made the means for striking a blow at our credit that causes it to totter the world over. Were it is so used, no representative of the people could stand up and blandly ask to have his electro-plated rag baby taken to the nation's bosom, and its life sustained at the expense of national vigour. We might then be spared the humiliation of reading advertisements in the journals of European cities, offering the services of bankers in exchanging United States securities for some safer investment, and this because those who should hold the national honour as the dearest thing on earth, are willing to even parley with the unfaithful ones, who, like Judas, would betray their master for thirty pieces of silver.

The general characteristic that more than any other impresses me is the absence of glare and the subdued and harmonious tone that has been given to the objects most recently made. I have noticed many effects produced by novel methods of ornamentation that have not yet become generally familiar, and which I shall endeavour to intelligibly describe. Conspicuous among these are silver articles inlaid with niello, somewhat after the manner of *champleve* enamel, and similar to the beautiful Russian work which excited such admiration at the International Exhibition of our Centennial Year. The art of applying this enamel was some time regarded as a Russian secret, though the metallic oxides of which it is composed (and which are fused into a homogeneous substance again by the process of heating in a furnace) were well known to our metallurgists, and it has lately been successfully employed by craftsmen of Paris and London.

The last year witnessed the development of this valuable ornamental agent in America, and its use in connection with silver is of the highest advantage, as it can be worked with equal facility in mass or in the most delicate lines. Unlike the vitrified enamels used in Oriental and European *cloisonné* or *champleve* enamels, niello will bend with the body into which it is inserted, and is not therefore liable to destruction by fracture, nor is it easily injured by abrasion.

In connection with this highly workable composition, which contrasts so well with the unequalled whiteness of silver, pure metals are also inlaid by an ingenious process, so that it is possible to produce a durable surface, having the beautiful polychromatic effects that until lately were possible only by the aid of such superficial methods of decoration as electro-gilding and oxidation. Copper, iron, and gold are used in this way, and what I have said in regard to the indestructibility of niello applies with equal aptness to inlaid devices of pure metals, which are not merely superficial, but equal in thickness to one-third that of the body into which they are inserted.

While these developments of metallurgy, because of their novelty, attract great attention at this day, the advance toward excellence in *repoussée* chasing is perhaps more interesting to observe. *Repoussée,* literally "pushed again," is the term applied to that process of chasing in which those parts of the ornament in highest relief on hollow bodies of metal are pushed outward by a tool within, and then repushed, or *repoussée*, with a more delicate instrument without, to form the finer lines of the design. The first, and to the uninitiated seemingly the most difficult part of this method of ornamenting, is easily accomplished by means of the snarling-iron, an iron bar crooked to opposite right angles at the ends, and narrowing toward the polished rounded point that is brought in contact with the silver. The larger end is made fast in a vice, the other inserted through the neck or mouth of the object to be adorned; and while a skilled workman holds it in the proper position against the upturned point of the snarling-iron, a lad strikes smartly with a hammer near the secured end. The impression on the metal body is caused by concussion, the metal being stretched to the desired extent. These impressions of the snarling-iron bear no resemblance to the finished design, but simply appear as rude excrescences on the otherwise smooth surface. When all the parts where figures are to appear in relief have been suitably impressed, the vesel is filled with a composition of pitch and other resinous substances sufficiently yielding to admit of indentations being made upon the outer surface. The object is then placed upon a leather cushion, and the truly artistic work is begun, and not even the painter's pencil is made to express more subtly the artist's idea than the tool of the skilful chaser.

From the days of that erratic Italian who left us, in imperishable bronze, his grand conception of the Gorgon's head dangling from the clenched hand of Perseus, from the days of the restless Benvenuto Cellini until now, no process of presenting designs in metals has been so much esteemed as the *repoussée* and the reason is manifest, for none is so clearly the work of man's mind and hand. The artist chaser can send into the pliant metal his very thought, and by the cunning of his hand render it palpable for ever. The extreme ductility of silver renders it highly susceptible to treatment by the *repoussé* process, and it is possible to produce the most delicately finished and expressive *repoussée* pictures.

The opportunities for the exercise of the highest abilities of our artisans in this delightful field of labour have until recently been extremely limited, but a more general appreciation of excellence in decorative art has done much to call them forth, and the requirements of trade which afford them employment now demand the most conscientious work.

It is gratifying to bear testimony to the fact that we possess workers of unsurpassed skill, and that our people have the taste and the will to encourage them. One conspicuous feature of the artistic metal work of our own country during the last decade of years is that the most elaborate, costly, and meritorious works have been objects of houshold use and not of exclusive luxury, and in this regard we differ from our English cousins, whose masterpieces at the International Exhibition of 1876 were mural plaques, vases, and other purely decorative objects, while ours were tea-sets, fruit-holders and like useful articles. Now, while this may indicate the utilitarian spirit of our people, I can not think it is to be noticed with regret; for the result of bringing objects of beauty into the familiar intercourse of daily life will not be to degrade them, but rather to elevate the taste of the generation growing up under the influence of such surroundings.

Disregard of ornament as a source of enjoyment is generally an indication of mental weakness or want of culture; and as extremes meet, it is common to observe the lavish use of decorative agents and total disuse of them alike by persons who are timid and vulgar.

In the enrichment of objects of silver, another method, which, by the models I have seen, is proved to be susceptible of rare delicacy of treatment, is styled *appliqué* work.

In the execution of the process required for the production of this work, the embellishments are separately wrought in the same manner as a piece of jewellery, and laid upon the surface of the object to be adorned, being held in place by ligatures of fine wire. A careful blast from a blow-pipe is then thrown upon it and perfect fusion secured between the surface and the applied ornament—which thus becomes a part of and homogeneous with the original body. In this manner, Japanese devices of birds, fishes, foliage, and human and other figures, lavish Persian ornamentation of floral and other decorations, are admirably treated. By this process of applying raised ornament, another feature of decoration is introduced which until the current year has never been known outside of the curious work-shops of the jealous Japanese, which no European or American may enter.

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* Of Messrs. Tiffany & Co., New York.

This new feature is obtained by means of a material which is applied in the manner I have described in regard to raised ornaments of silver, and for want of a better name I shall call it Japanese alloy. It is composed of metallic substances that are susceptible of receiving and retaining various shades of colour, as blue-black, grey, yellow, brown, violet and vermilion, which may be employed separately or together, and mixed with gold. The opportunities for metallic decoration which this wonderful and highly valuable compound afford are vast indeed, and render it easy to present the gorgeous plumage of birds, and all the beautiful hues which the wealth of Nature yields, in the durable form of metal objects. I regard the discovery of this secret—which is the result of a long series of patient experiments—as the most important step in artistic metal work which our country has taken, and its development will be watched with interest by all who are interested in industrial art in the United States. The use of this alloy, which is yet in its earliest infancy here, is likely to result in the production of rarer and costlier art objects of silver than modern art has known, and the chryselephantine treasures of archaic times will doubtless be rivalled by the many-coloured products of American workshops.

Still another mode of imparting superficial designs to metallic bodies without breaking their outlines, is the well-used one of engraving. Though when employed alone it is a feebler method than *repoussée* chasing, and by no means so decorative as *appliqué* work; yet, as an adjunct to the latter, and even in some cases alone, it proves a valuable and effective agent for surface decoration.

A peculiar effect wrought in conjunction with applied ornamentation, engraving, or even chasing, is produced by leaving the entire surface (except where some ornamental device is seen) impressed with the dints of the hammer. This unique finish imparts to the body an appearance not unlike that possessed by Japanese "crackle" pottery, and it certainly owns a quaint barbaric beauty. Other objects are indented with an edged hammer, horizontally, so that the lines appear like waves of water, and a very novel and pleasing effect is given by adding raised figures of fishes and marine plants.

Though mental sculpture presumably stands higher as an art than those methods of ornamentation I have named, yet so far as interior decorative objects of American manufacture evince, it must certainly take a subordinate place to *repoussée* chasing, which indeed offers every facility for delicate expression. To France still belongs the palm for figure modelling, and while we have made some worthy attempts, which are seen in recent examples of bronze as well as silver, yet, in the main, American metal statuettes that are shown in the shops are entirely destitute of merit. Bronze "ornaments" that would shock the artistic sense almost of a Parisian *chiffonnier*, monstrosities labelled Shakespeare and Dante and Columbus, to which one might bow down and worship without violating the decalogue (for they are shaped with utter disregard to any form of Nature or law of Art), are still bought by our well-to-do and intelligent provincial citizens, and placed conspicuously in their homes, where they continue to mislead the taste of inexperienced bucolic youth.

Now, a nice appreciation of artistic excellence is by no means necessary to perfect mental health (any more than to physical development), but it is particularly essential to the enjoyment of the higher pleasures of the senses. This appreciation is only to be gained by culture, and it is the duty of those persons who have obtained that culture to demand as nearly perfect work as the utmost effort can produce, and to accept nothing less on any plea whatever.

Cheapness has no place in art, and while the ordinary household articles, the spoons and tea-pots, may properly be simple and not costly, so soon as the art element enters, and the attempt is made to produce an object of beauty, something that shall gratify the sense, the hampering hand of economy must not be stretched out to destroy the effort. Only the best is good enough in art, and until those who have knowledge of what constitutes the best insist upon having it, there will be a plenty of "art workers" ready to sacrifice art to trade, and foist their meretricious wares upon the market.

QUERIES AND ANSWERS.

Having every facility for obtaining the latest and most reliable information on all subjects connected with the trades we represent, we have hitherto embodied the answers to numerous queries in "Trade Recipes" or special articles. At the request of many of our subscribers, whose suggestions shall always meet with our respectful consideration, we have determined to grant a space to Queries and Answers.

We shall spare no pains in making this new feature of our journal as instructive as possible, and we solicit the co-operation of all those who are disinterested enough to share their knowledge with their less-favoured fellow-craftsmen; for by a liberal interchange of ideas and experiences alone can progress be secured.

S. W. (Birmingham).—Can you, or any of your numerous readers, inform me how I can give a good polish to clock-weights?

Watchmaker.—We regret that we cannot supply you with all our back numbers, as some of them are out of print. We have a few complete copies of Vols. II. and III., which we can let you have at the usual price.

H. (Glasgow).—You will find the information you require in the present issue under the heading "Hardening and Tempering Steel Tools."

Value of Diamond Mines.—From the assessment of the Kimberley Mine recently made for Mining Board purposes, it appears that the total number of claims in that mine is 417·24, of the reteable value of £1,329,937, which would equal an outside value of over £1,700,000. As the annual export of diamonds is valued at £2,000,000, good mining property seems to bring in an excellent return.

The Electro-Metallurgical Company of Brussels has lately completed a colossal statue of Zan Van Eyck, in bronze, by the system of electric deposition. The galvanic process occupied several months, although a thickness of but six to eight millimetres was attained. It is believed to be the largest article which has been produced by this method, being over 12 feet in height, and is regarded as a much more perfect imitation of the model than could be obtained by casting.

Wholesale Frauds on Jewellers.—The countess Helena Gazewska has been arrested lately at Vienna for defrauding jewellers. It has been proved already that within a comparatively short time, her frauds at Paris amounted to 200,000 francs, at Marseilles to 150,000 francs, at Yverdun to 60,000 francs, at Nice to 35,000 francs, at Monaco to 20,000 francs, at Brussels to 10,000 francs, etc. The countess disposed of the jewels thus obtained to persons in good society, whom she made believe that the jewels were her own, and that she sold them in order to help the Russian wounded.

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PATENTS.

Applications for Letters Patent relating to Jewellery, Watches, Clocks, Optical Goods, or kindred articles.

1789. William Borthwick Smith, of Warwick Row, Coventry, in the county of Warwick, for an invention of "Improvements in watches, parts of which improvements are applicable to other time-keepers." —Dated 3rd May, 1878.

1840. George Lund, of the firm of Lund and Blockley, of 42, Pall Mall, in the city of Westminster, Manufacturers, for an invention of "Improvements in apparatus for synchronizing or setting clocks or other time-keepers."—Dated 8th May, 1878.

1847. Benjamin Edward Halford, of Smethwick, in the county of Stafford, Machinist, for an invention of "Improvements in fastenings for solitaires, studs, sleeve-links, boots, bags, and other articles."—Dated 8th May, 1878.

1879. Luigi Peroni, of 45, Hatton Garden, Holborn, in the county of Middlesex, Glass Blower, for an invention of "Improvements in the construction and formation of glass tubes employed in the manufacture of clinical and other thermometers, with the view of increasing the facility of reading the indications of mercury employed therein, as well as for other useful purposes in connection therewith." —Dated 10th May, 1878.

2015. George Frederick Handel Garrett, of Oldham, in the county of Lancaster, Watchmaker, for an invention of "Improvements in watches and clocks."—Dated 20th May, 1878.

2029. Robert Kirkland Muirhead, of Glasgow, in the county of Lanark, North Britain, Chronometer Maker, for an invention of "A new or improved mechanism for the synchronising of clocks."—Dated 21st May, 1878.

Notices to Proceed.

142. Thomas Shaw, of Birmingham, Tool Maker, and Frederick Arthur Walton, of Birmingham, Jeweller, have given notice in respect of the invention of "An improvement in shirt-studs, sleeve-links, and similar articles."

1641. Charles vander Woerd, of Waltham, county of Middlesex and state of Massachusetts, United States of America, has given notice in respect of the invention of "Improvements in compensation balances for watches and chronometers."

1526. Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, has given notice in respect of the invention of an "An improved metallic composition and process for coating metals and preserving them from oxidation."—A communication to him from abroad by Albert Paul Georges Daumesnil, of Paris, France.

333. Frederick James Ritchie, of Edinburgh, in the county of Midlothian, North Britain, Watch and Clock Maker, has given notice in respect of the invention of "Improvements in controlling timekeepers by electricity, and in apparatus therefor."

Grants of Provisional Protection for six months.

1447. To Maurice Mosely, of 9, Portsdown Road, Maida Hill, W., for the invention of "An improved appliance for rendering rings more secure while worn on the finger, which appliance may be used for other purposes."

1526. To Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for the invention of "An improved metallic composition and process for coating metals and preserving them from oxidation."—A communication to him from abroad by Albert Paul Georges Daumesnil, of Paris, France.

1608. To Thomas Brown, of Rood Lane, in the city of London, Engineer, for the invention of "An improved watch key or winder."—A communication to him from abroad by Frank Clifford Dennis, of Boston, Massachusetts, United States of America.

1546. To John and Benjamin Adkins, of the firm of Adkins and Sons, of Birmingham, in the county of Warwick, Electro-plate Manufacturer, for the invention of "Improvements in self-acting lids for claret and other jugs and vessels."

1664. To Walter Henry Collins, of Great King Street, Birmingham, Manufacturing Jeweller, for the invention of "Improvements in the manufacture of solitaires, studs, and other similar articles."

1789. To William Borthwick Smith, of Warwick Row, Coventry, in the county of Warwick, for the invention of "Improvements in watches, parts of which improvements are applicable to other timekeepers."

1847. To Benjamin Edward Halford, of Smethwick, in the county of Stafford, Machinist, for the invention of "Improvements in fastenings for solitaires, studs, sleeve-links, boots, bags, and other articles."

1857. To Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for the invention of "An improvement in watches."—A communication to him from abroad by Albert Guinand, of Marseilles, France.

Patents Sealed.

112. Clotilde Hubert, of Brussels, in the kingdom of Belgium, Manufacturer of Jewellery, for an invention of "Improvements in bracelets and necklaces."—Dated 9th January, 1878.

4317. Thomas Morgan, Secretary of the Inventors' Patent-right Association, Limited, 21, Cockspur Street, Charing Cross, in the county of Middlesex, for an invention of "Improvements in key-rings."—A communication to him from abroad by John S. Birch, of New York, United States of America."—Dated 17th November, 1877.

90. Charles Riballier, of Paris, in the republic of France, Jeweller, for an invention of "An improved process of discolouring coloured diamonds."—Dated 7th January, 1878.

Patents on which the Stamp Duty of £50 has been paid, and Dates of their Production for Certificate.

1852. Richard Whittaker, of 8, Eton Grove, Dacre Park, Blackheath, London, for an invention of "Improvements in keyless going barrel watches."—Dated 19th May, 1875.

Patents Granted in Foreign States.

United States of America.

198,195. John A. Finch, of Indianapolis, Ind., for "Opera-glasses."—Application filed 8th October, 1877.

198,207. W. A. L. Miller, of San Francisco, Cal., for "Manufacture of cabinet jewellery."—Application filed 26th October, 1877.

198,211. John W. Post, of New York, N.Y., for "Metal-turning lathes." —Application filed 28th November, 1877.

198,268. Lars P. Bergstrom, of Rock Island, Ill., for "Winding-alarms for clocks."—Application filed 27th October, 1877.

198,390. H. C. Jacot, of St. Louis, Mo., for "Pendulum-regulators for clocks."—Application filed 19th November, 1877.

198,577. H. J. Davies and Walter D. Davies, of Brooklyn, N.Y., for "Illuminated-dial clocks."—Application filed 1st November, 1877.

198,607. Ernst Gundlach, of Rochester, assignor of one-half of his right to John J. Bausch, of the same place, and Henry Lomb, of Brooklyn, N.Y., for "Stages for microscopes."—Application filed 28th November, 1877.

198,782. Robert B. Tolles, of Boston, Mass., for "Microscopes."—Application filed 27th July, 1877.

198,914. Ernst Gundlach, of Rochester, N.Y., assignor of one-half of his right to John J. Bausch, of the same place, and Henry Lomb, of Brooklyn, N.Y., for "Object-glasses for microscopes."—Application filed 28th November, 1877.

199,181. Reinhold Boeklen, of Brooklyn, assignor to Chas. A. Waterbury, of New York, N.Y., for "Tell-tale clocks."—Application filed 13th June, 1877.

199,198. Augustus I. Goodrich, of Waterbury, Conn., assignor to Waterbury Clock Company, of the same place, for "Clocks."—Application filed 19th December, 1877.

199,218. John H. Mather, of Chicago, Ill., for "Eyeglasses for watch-makers."—Application filed 23rd August, 1877.

199,365. Charles E. Hayward, of Attleborough, Mass., for "Watch-guard tips."—Application filed 25th June, 1877.

199,392. Chas. V. Woerd, of Waltham, Mass., assignor to the American Watch Company, of the same place, for "Potances for watches."—Application filed 7th December, 1877.

199,442. John S. F. Huddleston, of Boston, Mass., for "Thermometers."—Application filed 4th January, 1878.

10,383. James W. Miller and Isaac M. Miller, of Newark, N. J., for "Articles of jewellery."—Application filed 3rd December, 1877.—Term of patent 7 years.

199,580. Wm. Riker, of Newark, N.J., for "Methods of ornamenting metallic surfaces for jewellery, &c."—Application filed 17th January, 1878.

10,411. Arnold Robert, of Brooklyn, N.Y., for "Watch-cases or lockets." Application filed 28th December, 1877. Term of patent 14 years.

Belgium.

44,896. C. Henard and Lasnier, for "A cosmographic clock.—Dated 17th April, 1878.—Original Patent, 4th May, 1877.

Italy.

84. G. Pirazzi, of Pallanzeno, for "A decimal clock."—Dated 12th April, 1877.

119. C. Henard and E. Lasnier, of Paris, for "A cosmographic clock."—Dated 17th May, 1877.

8029. Edward Balbach, junr., of Newark, N. J., for "Retorts for seperating zinc from gold and silver alloys.—Patent No. 64,934, dated 21st May, 1867.—Re-issue No 5461, datcd 24th June, 1873.—Application filled 24th December, 1877.

10. A. Lion, of Paris, for "Novel bracelets."—Dated 22nd September, 1877.

123. C. Fritsch and J. Forster, of Vienna, for "A special telescope."—Dated 25th November, 1877.

141. L. Bianchi and C. Marini, of Milan, for "Converting common watches into remontoir watches."—Dated 12th December, 1877.

France.

Certificates of Addition.

113,108. Clemandot, for "Applying nickle for preventing oxydation."—Dated 28th December, 1877.

116,210. Collin, for "Public alarm clocks."—Dated 22nd December, 1877.

121,465. Aclogue, of Paris, for "Safety-buttons for jewellery."—Dated 4th December, 1877.

121,468. Revillon, for "A wedding-bracelet with openings."—Dated 4th December, 1877.

121,535. Planchet, for "A geocosmographic clock."—Dated 15th December, 1877.

121,543. Blanchette, of Paris, for "A pendulum for clock-work."—Dated 10th December, 1877.

121,548. Cotte, for "A so-called 'mysterious watch-case.'"—Dated 10th December, 1877.

121,572. Drouhin, for "A so-called 'tramway musical box,' and manufacturing the same."—Dated 12th December, 1877.

121,600. Goulier, of Paris, for "So-called 'megaloptic eye-glasses.'"—Dated 14th December, 1877.

121,630. Japy, Brothers, and Co., for "A watch-motion with a gullet teeth escapement."—Dated 15th December, 1877.

121,633. Petit, for "An alarum."—Dated 16th October, 1877.

121,639. Roussel and Aubriot, sen., for "Spring fastenings and openings for bracelets and other jewels."—Dated 23rd November, 1877.

121,682. Japy, Brothers and Co., for "Improvements in clock-work."—Dated 19th December, 1877.

121,688. Rosset, of Paris, for "A clock-pendulum with a mysterious motion."—Dated 19th December, 1877.

121,712. Piron, for "Stamping tubes, imitating so-called 'reperće' work for watch-keys and other jewelry articles."—Dated 20th December, 1877.

121,713. Piron, for "Mixed plating for articles of jewelry."—Dated 20th December, 1877.

121,736. Badollet and Co., for "A gauge for remontoir watches."—Dated 21st December, 1877.

121,835. Orry, of Paris, for "So-called 'Cecilian chains for metal jewelry.'"—Dated 29th December, 1877.

Germany.

1356. O. Welter, of Berlin, for "A firing burglar-alarm."—Dated 20th September, 1877. Class 74.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Coulson, Jno. Wm. Edmund, Mill-street, Crewe, clock and watch maker. April 27. F. Warburton, sol., Crewe.

Emms, Joshua, Camberwell-road, Camberwell, and 4, Maude-road, Camberwell, jeweller. April 29. J. Scoles, sol, 70, Queen-street, Cannon-street.

Gardner, Wm., junr., Bolton-road, Pendlebury, late Yew Bank, Lower Broughton, watchmaker. April 30. J. H. Dewhurst, sol., Victoria-street, Manchester.

Cragg, Samuel, 57, Trafalgar-street, Leeds, jeweller. May 9. Hopp & Bedford, sols., Bank-street, Leeds.

Buck, Charles, 62, Red Lion-street, gilder and plater. May 6. S. T. Cooper, sol., 123 Chancery-ln.

Hargan, David Amner, Blackheath Hill, watchmaker. May 15. Scard & Son, sols., 10, Eastcheap.

Ashton, Thomas Heard, Bridgend, Glamorganshire, watchmaker & jeweller. May 22. Morgan & Scott, sols., Cardiff.

Cooper, Henry James, trading as H. J. Cooper & Co., 90, Newgate-street, jeweller, &c. May 22. At Gush & Phillips', sols., 3, Finsbury-circus, June 6 at 2.

McKenzie, John, Downham Market, Norfolk, watchmaker, &c. May 17. E. S. Copeman, sol., Downham Market.

Morgan, Henry William, 109, Lake-road, Landport, jeweller. May 23. At Chamber of Commerce, 145, Cheapside, London, June 14 at 12. Blake & Reed, sols., Portsea.

Trustees Appointed.

Henry, Alexr. (Liq), Hatton-garden, dealer in jewellery. Tr., P. Mauthner, of the firm of Goldschmidt and Sons, Holborn, & A. Henry, 5, Furnival's Inn, accountant.

Hawkins, Ebenezer A. & Frederick Silver (Bkt), 6, Richard-street, Vyse-street, Birmingham, jewellers. Tr., L. J. Sharp, 47 Ann-street, Birmingham, accountant.

Jennens, Charles (Bkt), William-street, Lozells, near Birmingham, jeweller. Tr., S. Kohn, Spencer-street, Birmingham, jeweller.

Smith, William H. (Liq), Upper-street, Islington, watchmaker. Tr. J. L. Langman, 11, Hatton-garden.

Scotch Sequestrations.

Picken, Wm., 9, Melbourne-place, Edinburgh, watch and clock maker. May 27, with protection. Tr., and Com., Lyon and Turnbull's, 51 George-street, Edinburgh, June 4 at 2. Claims by Sept. 27. Agents, Ferguson and Junner, 46, George-street, Edinburgh.

Discharges Granted and Bankruptcies Closed.

Cotterell, Andrew, Frederick-street, Birmingham, jeweller. (A div. of 17/1½ has been paid.) Bktcy. closed Apr. 11.

Adjudications of Bankruptcy.

Hawkins, Ebenezer Alfred and Frederick Sirver, Richard-street Birmingham, jewellers. May 2.

Jennens, Charles, William-street, Lozells, near Birmingham, jeweller. May 1.

Allgemeines Journal der Uhrmacherkunst.

Illustrirte Fachzeitschrift fur Uhrmacher.
Redacteur: EMIL SCHNEIDER, LEIPZIG, Germany.
Verlag and Expedition: HOFFMAN & SCHMIDT, LEIPZIG.
Agent for Great Britain and Colonies: H. BUSH'S Publishers' Agency, Hull, Yorkshire.

This journal appears weekly, and will be sent post-paid for 2s. 6d. per quarter or 10s. per annum. Siogle copies 4d. Advertisements are charged 3d. per five-parted line.

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COVENTRY WATCH COMPANY.

THE *Investors' Guardian* announces the conversion into a company bearing this title of the business of a watch manufacturer carried on by Mr. William Borthwick Smith, at Coventry. An unregistered agreement of 6th ult. regulates the purchase, which includes the stock-in-trade, plant, fixtures, letters patent, and other effects of the said business, and also the tenancy of premises 9 to 12, Junction Street, and 28 and 29, Albion Street, Coventry. The company was incorporated on the 17th ult., with a capital of £40,000, in £10 shares. The number of directors is not to be less than three nor more than six. The subscribers are to appoint the first four directors. The qualification of future directors will be determined by the company in general meeting. The directors are to receive a minimum remuneration of £180 per annum, to be increased to £10 per cent. upon all profits divisible amongst the members above what will pay £10 per cent. per annum dividend upon the paid-up capital.

PEARLING IN WESTERN AUSTRALIA.

THE pearl-fishing season off the north-west coast of West Australia is reported to have been very successful, and a great impetus has been given to the industry by the high prices prevailing in the English markets for pearls and nacre, or mother-of-pearl. Operations are now conducted along a much greater extent of shore than was formerly the case, and some good takes of pearls have been made on new grounds. The facility with which pearling grounds may be fished out suggests the desirability of similar steps being taken here to those already adopted in Ceylon, to check over-fishing and prevent the exhaustion of the beds. The pearl mussel, it is now known, is in its prime for only a comparatively short period of its existence. If taken too young great difficulty attends the work, and the pearls are small in size and poor in quality. If allowed, on the other hand, to remain too long on the beds, the mussels are easily washed away by currents, storms, or tidal influences, and the produce is therefore lost. It is believed that at about five years of age the mussel is in the best condition to be taken, and it is necessary for careful observations and experimental fishings to be continually made in order to ascertain when a bed is in fit condition for the divers to work upon it. The experience of Ceylon should act as a warning in due time to the authorities of Western Australia, or an industry which is now attaining important dimensions may be suddenly and perhaps irretrievably lost.—*Colonies and India.*

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HOROLOGY.

(*Continued from page* 267, *vol.* 3.)

XXXV.—The Pendulum.

By Amédée Guillemin.*

NEWTON, seated one day in his garden at Woolsthorpe, saw an apple break off from the branch of a tree, and fall at his feet. It was this simple circumstance which suggested to him his profound researches in the nature of the force of gravity, and which made him ask whether this mysterious action, to which all terrestrial bodies are subjected, whatever their height in the atmosphere, whether at the bottom of valleys or at the top of the highest mountains, did not extend even to the moon. Thanks to the meditations of this great genius, we had not long to wait for the solution of such a grand problem; but it was not till twenty years later that the edifice of which Kepler, Galileo and Huyghens had prepared the foundation which the successors of Newton finished, and which bears this triumphant superscription—" Universal Gravitation "—was at last constructed in its majestic beauty.

Is this anecdote, repeated by all biographers of the great man, really true? It matters little; the essential point is that it is probable. But we should be mistaken if we imagined that it was of a nature to diminish the fame of the philosopher. Such things had happened millions of times before, to his ancestors and to his contemporaries. A fact like the falling of an apple could only excite such thoughts in a mind capable of the highest speculations, and moved by a will powerful enough to be always thinking them out.

It was a similar occurrence which caused Galileo to undertake his researches on the motion of the pendulum. He was then professor at Pisa, and was studying the laws of falling bodies. "One day," we read, "while present at a religious ceremony in the cathedral—paying, however, it would seem, very little attention to it—he was struck by a bronze lamp—a *chef-d'œuvre* of Benvenuto Cellini—which, suspended by a long cord, was slowly swinging before the altar. Perhaps, with his eyes fixed on this improvised metronome, he joined in the singing. The lamp by degrees slackened its vibration, and, being attentive to its last movements, he noticed that it always beat in the same time."†

It was this last observation which struck Galileo. The lamp, when the motion had nearly ended, described smaller and smaller arcs through the air, the period of swings, however, remaining the same. The able Haldino philosopher repeated the experiment, and discovered the connection which exists between the period of oscillation and the length of the cord supporting the oscillating weight. Huyghens completed this beautiful discovery, and gave the mathematical law of the motion of the pendulum. The simple pendulum and the laws which govern its oscillatory movement are familiar to every one, and the same laws have been successfully applied to the oscillations of compound pendulums, and the resistances which necessarily proceed from the relative imperfection of the pendulums have been taken into account with every possible precision. These laws, which it is so important to understand, and which have made the pendulum the best instrument for the measurement of time, the most precise indicator of the irregularities which the terrestrial spheroid presents, and a scale by the aid of which the density of our planet and of all the bodies of our solar system can be weighed, may now be stated.

---

* Translated from the French by Mrs. Norman Lockyer.

† Z. Bertrand, " Galileo and his Works."

The first law is that discovered by Galileo from observation: it is as follows:—

"*The time of very small oscillations of one and the same pendulum is independent of their amplitude; the oscillations are isochronous—that is to say, they are all performed in the same time.*" By small oscillations must be understood those the angle of which is less than four degrees. Within this limit the oscillations of greater amplitude are made in a very little longer time than the others, but the difference is very slight, and it is not until after a great number of oscillations that all the little differences of which we speak become perceptible.

It is theory, then, which demonstrates the isochronism of pendulum oscillations. But the law is easily verified by experiment. If we carefully count a considerable number of oscillations, and by a good chronometer measure the number of seconds elapsed, these two numbers obtained give, by simple division, the time of one oscillation, which will be found to be the same either at the beginning or at the end of the experiment. This equality in the time required for passing through unequal distances, under the influence of a constant force, appears singular at first sight; but on reflecting a little it will be understood, without further demonstration, that in the case of greater amplitude the pendulum commences its swing in a direction more out of the vertical; the force of gravity, therefore, gives it greater velocity, by the help of which it soon makes up for the lead which a similar pendulum would have in describing an arc of less amplitude.

The second law which governs the motion of the pendulum establishes a relation between the time of the oscillations and the length of the pendulum. Let us imagine a series of pendulums, the smallest of which beats seconds, the others performing their oscillations in 2, 3, 4 . . . seconds respectively. The length of these last would be 4, 9, 16 . . . times greater than the length of the first, the times following the series of the simple numbers, the lengths following the series of the squares of these numbers. This is expressed in a more general manner by saying, *The periods of oscillation of pendulums are in the direct ratio of the square roots of their lengths.* Theory and observation agree in demonstrating this important law; but since we speak of experimental verifications, and know that it is impossible to realise a simple pendulum, it is time to state how the laws of this ideal pendulum are applied to the real or compound pendulums.

Pendulums of this kind are ordinarily formed of a "bob," or spherical ball of metal, with a rod adjusted in the direction of the centre of figure of the sphere or of the bob. This rod is fixed at its upper part into a sharp metal knife-edge, which rests on a hard and polished plane. Such are the pendulums the oscillations of which control the motion of clocks. In such a system, what is understood by the length of the pendulum is not the distance from the point of suspension to the lower extremity of the heavy body, but the approximate distance between this point and the centre of figure of the ball, when the rod of the pendulum is thin, and the ball is made of very dense metal—platinum, for example. This last point then takes the name of centre of oscillation. We will show the reason for this fundamental distinction.

In a simple pendulum there is only considered to be one material point; in the compound pendulum their number, whether in the rod or in the ball, is infinite. It is as if there were a series of simple pendulums of different lengths compelled to execute their movements together. Their most distant particles find their movements accelerated; contrariwise, it is retarded in the case of those nearest the point of suspension. Between these extremes there is one particle, the duration of whose oscillations is precisely equal to those of a simple pendulum of equal length. Calculation makes us acquainted with the positions of this particle—that is to say, the point which we have just termed the centre of oscillation.

Let us now try to understand how it is possible, by means of pendulum observations, to solve several important questions which deal with the form of our planet and its physical constitution. The periods of the small oscillations of a pendulum depend upon its length, according to the law we have just stated. But these two elements also depend on the intensity of the force of gravity in the locality where the oscillations are performed. Hence it follows that, if we observe with great precision the number of oscillations that a pendulum, the length of which is known with rigorous exactness, executes in a sidereal day, we shall be able to calculate the precise duration of a single oscillation, and thence deduce the intensity of the force of gravity—that is to say, twice the space which a heavy body falling *in vacuo* passes through in a second. This intensity is, in fact, connected with the length of the pendulum and the period of its oscillation. It is by this method that the value was found for the latitude of Paris—9.8094 metres.

This determination once obtained, it is possible to obtain by calculation the length of the pendulum which beats seconds. This length is at Paris 0·994 metre; at London 3·2616 feet. Now, let us imagine that an observer travels from the equator to either pole. As the earth is not spherical, the distance of the observer from the centre of the earth will vary. Greatest at the equator, it will progressively diminish, will pass through a mean value, and will be the smallest possible at the poles themselves. Now, for this reason alone, the energy of the action of gravity in these different places must decrease from the poles to the equator. Another influence will also contribute to diminish the intensity of this force—that is, the rotation of of the earth, the velocity of which, being *nil* at the two poles, progressively increases with the latitude, developing at each point a greater centrifugal force, which partly counterbalances the action of terrestrial gravity.* For these two reasons, the intensity of the force of gravity will vary in different latitudes. How will our observer perceive it? By observing the oscillations of the pendulum, which furnishes us with two different but equally conclusive methods. The first method consists in employing a pendulum of invariable length; the rod and the bob, soldered together, are fixed to the knife-edge in a permanent manner. Such a pendulum, having a constant length, or at least only varying with changes of temperature, will oscillate more rapidly as the force of gravity is increased; so that in going from the poles to the equator the number of oscillations in a mean day will be smaller and smaller. Thus, a pendulum a metre in length, which at Paris makes in vacuo 86,137 oscillations in twenty-four hours, if carried to the poles would make 86,242, and at the equator would only make in the same time 86,017 vibrations.

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* The centrifugal force may be rendered manifest by an apparatus in which circles of steel rapidly turn on an axis. They take the form of ellipses flattened at the extremity of the axis, the flattening being more considerable as the velocity of rotation is greater.

NEW IDEAS IN WATCH MANUFACTURE.

In another portion of this Journal our readers will find reprinted, a pamphlet upon the going-barrel and other related subjects recently issued by the English Watch Company of Birmingham.

Some of our British readers may have seen it, and to them our publication will simply give to it permanence and the means of ready reference; our large circle of foreign subscribers, however, are necessarily in ignorance of the discussion, and in their interests we deem it useful to devote a portion of our space to the paper in question.

We are gratified to perceive in the British trade an increased interest in those practical matters, upon the right understanding of which, in these days of competition, much of success depends, and we could wish that definite points of trade usage were more frequently taken up and debated; indeed, we can conceive no better use of our pages than to chronicle the modifications and improvements which, in the varied departments of Horology, Jewellery, and Silversmiths' work, are constantly being made, and in the discussion of those practical subjects which from time to time come to the front in relation to the trades whose interests we support.

It may be thought that when a topic is advocated by those directly interested, that it is apt to be unduly pressed; but, on the other hand, there is an undoubted advantage in having a proposition stated and urged in the very words of its promoters, and we do not at all anticipate that our intelligent readers are likely to be carried by any special pleading farther than their reason concurs.

The paper in question, however, in our opinion, presents the debatable points with so much fairness and candour, that on the grounds just named we do not hesitate to commend it to the consideration of our readers.

We are of course prepared to find it said in certain quarters that we are advocating an innovation that interferes with the established home trade. We deny that in any rational sense this is so; for apart altogether from the present subject, affirm that we are not advocates of anything that we do not believe to be of advantage to the interests of our readers. But surely the time has come wherein it is evident that if the home trade is to remain a *home* trade, it must follow the exigencies of the time, must avail itself of the best principles and methods, and must be prepared to discard many of those traditions which have hitherto been as its very life, but which to-day hamper and embarrass it to an extent that is only realised by those who, like ourselves, look at the circumstances from an objective point of view.

We do not anticipate that with regard to the finest class of watches for which England is still unrivalled there will be much interference with the present methods; but so far as the popular article is concerned, it is folly to deny that a new order of things has set in, and the trade will show true wisdom by no longer affecting to deny the inevitable; but rather, by accepting the change that is already upon us, and conforming, as far as the growth of circumstances will allow, to the requirements of that change, be prepared to reap the benefits of progress, rather than, by a futile opposition, take part in a seed-sowing that will hereafter bear a harvest of disappointment and useless regret.

The spirit of enterprise shown by the English Watch Company in pioneering the way for machine production, is in every way commendable; it is equally certain that this Company will continue to receive, as indeed it fairly deserves, the rewards consequent on the promptitude to perceive, and the energy to carry out a new and fertile idea; but as we do not believe in monopolies, so in looking ahead we can see, even as though the vision were now realised, manufacturing watch industries within the borders of Britain sufficient in number and in organisation so complete as to be able to supply not only our own home requirements, but also the wants of our growing colonies and foreign dependencies. Anything falling short of this would be a discredit and a dishonour to our national character and our best mercantile traditions.

SHAM CAPE DIAMONDS.

The large and rapid output of diamonds from the diggings in South Africa has tended to depreciate the market price of these gems, and their value is likely to be still more seriously impaired by a report which has been spread abroad that many of the so-called Cape diamonds, though in appearance perfectly genuine and of good water, are artificial and really worthless. The brilliancy of many of these sham gems is so great as at first sight to deceive even experts; and it it is therefore not surprising that the general public should look with suspicion on any brilliants that may be offered for sale. In the case of the spurious diamonds manufactured of "paste," there is, however, a simple test, which is easily applied by anybody, and which is perfectly infallible; viz., to draw a fine file sharply across the suspected gem. On the soft paste, the file will leave a well-defined mark; but it is powerless to injure a real diamond, the owner of which need not fear the application of this rough-and-ready test. Besides the manufacture of the thoroughgoing "paste" diamonds, however, which are turned out to a great extent, there is practised a species of fraud known as the "doublet" fraud, which it is much less easy to detect. This is described by a well-known jeweller as "the combination of a well-cut crystal with the facing of a genuine diamond, the latter so thin in itself as to be comparatively worthless, but when cemented with a colourless cement on to the face of the crystal is likely to deceive the best judges, and enhance the value 1,000 per cent." Here the file ceases to be a test unless the "stone" is taken from its setting. Then an application of the steel instrument to the edges resolves any doubt. This removal of a stone from its setting, however, is a matter of difficulty, perhaps of impossibility, under certain conditions, but as the best diamonds are set with the "open setting," *i.e.* with the back exposed to view from underneath the ornaments, it ought not to be difficult to be on one's guard against an apparently good diamond not so set. The following mode of examining suspected stones is suggested by a correspondent of the *Times,* and may be of use in these and other cases:—"If the specimen is immersed in water, should it be a diamond it will sparkle with almost undiminished light and brilliancy of colour; but if it be spurious, whether paste or rock crystal, the 'fire' of the jewel will be completely quenched." On this point the particulars concerning the effect of light on diamonds, which will be found in another column, though not bearing directly on the subject under consideration, may be useful in suggesting some further simple and generally applicable mode of testing gems. Professor Soustadt, F.C.S., of 15, Fish Street Hill, has invented a liquid by means of which the specific gravity of diamonds and other precious gems may be easily tested by placing them therein. Professor Soustadt offers to give particulars of the mode of preparing this liquid to any one who may apply to him. For use in the Colonies, however, where the gems are bought and sold unset, and often uncut, the use of the file is perhaps as simple and efficacious a test as could be suggested. In the case of doubtful stones in the matrix state, when the miner is uncertain whether he has found a real gem or a mere piece of quartz or trap, the use of Soustadt's liquid would soon solve the doubt.—*Colonies and India.*

An exhibition of ivory work, both in relation to the fine arts and to industry, will be held in Florence.

OUR PARIS LETTER.

(From our own Correspondent at the Exhibition.)

THE English section is a favourite resort of all classes of foreign visitors, and to judge from the numerous comments to which I have listened from day to day, I am enabled to say that they are not only highly gratified, but often surprised, at the vast amount of skill and progress embodied in the exhibits of our country. I regret, however, that this eulogium does not apply to our watchmaking and jewellery display. The few exhibitors in these classes are quite lost amongst the brilliant array of metal-work, glass, pottery and furniture. Sir John Bennett, G. E. Frodsham, M. Riego, and V. Kullberg are the only representatives of the English watch trade. Either of the makers just mentioned are quiet capable of sustaining the reputation which first-class English work enjoys; but what we wanted was to show the world what English watch manufacturers can do for the million. Where is Coventry and Birmingham? Some time ago, one of the leading Swiss watch manufacturers told me that England would never be able to manufacture a watch suitable for the pocket and purse of the British workman. Fully anticipating that such makers as the English Watch Company, Wallen, Michael, Newsome and Yeomans, Rotherham, Cowen, Radgers, Hill, and others would be represented here, I promised to show him some work with the price and quality of which he would be astonished. Unfortunately, I have been disappointed: none of these firms have shown up, and my opponent is more than ever convinced of the truth of his assertion. Our representative watch manufacturers have no doubt valid reasons for absenting themselves from this magnificent show; but I think it a great mistake. As it is, the British Horological Section is no where in comparison with France, Switzerland and America.

Among the horological exhibits attracting the eye of the general public is a clock built by Stephen Engle, a watchmaker of Hazleton, Pa., and purchased by a Mr. Reid for the sum of $5,000. This clock stands eleven feet high. At its base it is about four feet wide, and at the top about two. It is about three feet deep at the base; gradually less towards the top. Its colours are brown and gold. The Strasburg clock is thirty feet high, yet its mechanism is not so intricate, nor has it as many figures as the Hazleton clock. The Strasburg clock's figures are about three feet high, and the American clock about nine inches. Three minutes before the hour a pipe organ inside the clock plays an anthem. It has five tunes. Bells are then rung, and when the hour is struck double doors in an alcove open, and a figure of Jesus appears. Double doors to the left then open, and the apostles appear slowly, one by one, in procession. As they appear and pass Jesus they turn towards Him, Jesus bows, the apostles turn again, and proceed through the double doors in an alcove on the right. As Peter approaches, Satan looks out of a window above and tempts him. Five times the devil appears, and when Peter passes denying Christ, the cock flaps its wings and crows. When Judas appears Satan comes down from his window and follows Judas out in the procession, and then goes back up to his place to watch Judas, appearing on both sides. As the procession has passed, Judas and the three Marys disappear, and the doors are closed. The scene can be repeated seven times in an hour, if necessary, and the natural motion of the clock produces it four times per hour, whereas the Strasburg procession is made but once a day, at twelve o'clock. Below the plaza is the main dial, about thirteen inches in diameter. To its right is a figure of Time, with an hour-glass. Above this is a window, at which appear figures representing Youth, Manhood, and Old Age. To the left of the dial is a skeleton representing Death. When the hour-hand approaches the first quarter, Time reverses his hour-glass, and strikes one on a bell with his scythe, when another bell inside responds; then Childhood appears instantly. When the hour-hand approaches the second quarter, or half-hour, there are heard the strokes of two bells. Then Youth appears, and the organ plays a hymn. After this Time strikes two, and reverses his hour-glass, when two bells respond inside. One minute after this a chime of bells is heard, when a folding door opens in the upper porch, and one at the right of the court, when the Saviour comes walking out. Then the apostles appear in procession. The clock also tells of the moon's changes, the tides, the seasons, days, and day of the month and year, and the signs of the zodiac; and on the top a soldier is constantly on guard, walking to and fro. As the hours advance, Manhood, Old Age, and Death take part in the panorama. It is reported that this ingenious watchmaker has never seen the Strasburg clock, and that this complicated mechanism is entirely his own conception, the result of no less than twenty years' labour. It is evident that he is a master in the art of clockmaking, but I think that the intelligence and perseverance which the execution of such a work must have required might have been better employed in search of improvements for astronomical or ordinary household timepieces.

Some novel and ingenious clock work is shown by various Parisian firms, and I shall send you full particulars of what is most likely to interest your readers in one of my future communications. As might have been expected, the French clock manufacturers have done their best to display their tasteful productions, and I must confess that their show is a grand one. This superb collection comprises some real works of art, of such exquisite design and workmanship as to satisfy even the most fastidious taste. Of course, there is also a goodly lot of wares which can claim neither elegance nor novelty; nothing beyond what may be seen in any respectable clock shop. This feature pervades, however, many other departments as well, and I fancy the dimensions of this vast bazaar would be considerably reduced if only such articles were allowed to enter as are really worthy of being exhibited.

Paris, like London, is represented by some first-class chronometer makers, who show work of a very high order. Besançon is, however, the seat of the French watchmaking industry, and not Paris. Watchmaking was first introduced in Besançon in 1793, by a few political fugitives from the watch manufacturing districts of Switzerland. The introduction met at the outset with numerous obstacles, and although 364 gold and 9,106 silver watches were submitted to the Controller in 1799, it was not till 1842 that the native population took to the fresh pursuit offered them. From that time, the bisontine watch trade made rapid progress.

In 1846	...	54,192	watches were stamped.
„ 1856	...	160,165	„ „ „
„ 1866	...	305,405	„ „ „
„ 1876	...	455,968	„ „ „

Last year Besançon turned out a million and a half of watch and half a million of clock movements; a production representing a value of three hundred and sixty thousand. These figures need no further comment, and bisontine watch manufacturers have every right in claiming the honour of having made watchmaking a French industry. While talking of Besançon, I may state that out of a population of about fifty thousand, from fifteen to sixteen thousand are employed in horological pursuits. About forty thousand more gain a living by the same kind of work in other parts of the Departement Du Doubs, of which Besançon is the centre. The manufacturers of this city, instead of making a few ineffective individual displays at the Exhibition, have come to the sensible arrangement of making common cause of the interests of their industry, and thus offer a collective show worthy of the importance of their trade. The workshop which they have erected, where a dozen skilled craftsmen may be seen at work on the various parts of a watch, renders material assistance in drawing the attention of the public to bisontine manufactures. This *atelier* is under the superintendence of a thoroughly experienced watchmaker, the chosen representative of the manufacturers of Besançon; and to his courtesy I am indebted for the above particulars relating to the origin and progress of watchmaking in the Departement Du Doubs.

The Swiss horological section attracts universal notice, and, taken as a whole, is beyond dispute a great success. Some idea of the extent of their exhibits may be gathered from the fact that they represent a value of about a hundred and twenty thousand pounds. It is certain that all the means at command have been employed to show the world that the Swiss watch trade is not so bad off as some have tried to make out. There is no denying that with such work as the Swiss show here, they can still claim the position of a first-class watch manufacturing nation. A great number of the watches have certificates attached to them, proofs of their having successfully undergone the severe tests of the Swiss observatories. Mr. Favre-Brandt, a well-known Geneva maker, exhibits an interesting collection of movements in every stage of completion. Special mention deserves a splendid specimen of mechanical art by Messrs. Golay-Leresche & Fils. In a massive silver coffret, only eight inches high, are united the principal branches of Genevese industry, as watchmaking, engraving, chasing, enamel painting, etc. In the centre is a marine chronometer beating half-seconds. On a small door to the left the zodiacal signs are indicated, and beneath it are two dials marking the days of the month and the days of the week respectively. Another small door to the right encloses three figures painted in enamel, and representing the three principal phases of weather—viz., fine, variable, rainy. The three paintings on enamel represent the three different styles of Genevese painting. Four figures, one at each corner, symbolise the four seasons. The chief interest centres, however, in a handsome group of figures on the top of the coffret. Every hour a little bird makes its exit from the trunk of a tree, sings, and flaps its wings in a most natural manner. The same tune is repeated by a cowherd sitting on a rock. This charming duet is, however, suddenly interrupted by the approach of a cat, which makes a spring towards the bird : both bird and cat then disappear, and the song ceases.

The Swiss section contains also a number of new and improved watch tools, complete descriptions of which I shall forward in due time.

The best individual display of watches in the whole Exhibition is that of the American Watch Company. This firm has evidently spared neither trouble nor expense in bringing its vast resources worthily before the public. They have secured a liberal space, and the magnificent case containing their exhibits is in itself an attraction. Whenever I pass through the American section I find quite a concourse of people around this elegant show, all desirous of seeing for themselves what these much talked of American watches really are. I have met several manufacturers from abroad who have come to Paris for the special purpose of examining the manufactures of this company. Unwilling to believe that this firm should have succeeded in such a short space of time to compete successfully with European makers, they are not a little surprised at the prices and qualities of the goods offered. The American Watch Company exhibits every grade of watch manufactured by them, from the ordinary silver watch to the most highly finished gold watch. A great favourite is the "American Stem Winder." It is a keyless watch, with hand setting, and most beautifully finished. What particularly secures notice is an imitation English watch. These manufacturers, instead of forcing American ideas on the English market, have wisely undertaken to produce something to suit our requirements and taste. This watch is provided with the new patent heart regulator.

The first quality watches shown have a newly invented compensation balance, which allows arriving much quicker and closer at the proper adjustment to heat, cold and isochronism. Parisian watchmakers, who have for a long time made a special study of isochronism, take a great interest in this compensation balance, and speak of it in very high terms.

As the description of this balance would require going deeply into scientific matters, I must postpone it to some future occasion. Another exhibit universally admired is their Ladies' "Royal Stem Winder," made especially for the English market. The Company displays some very handsome cases in *cloisonné* enamel, which were much admired by their Royal Highnesses the Prince and Princess of Wales, who spent a considerable time in examining their exhibits, and are said to have made some purchases. A sample of 200 watches supplied by the Waltham to the Indian Government is an object of special interest to watch manufacturers. American clocks are shown by the Seth Thomas and Ansonia Clock Companies, firms which are well known in this country.

In my next I shall give you my notes on the exhibits in the jewellery and metal line.

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from page* 268, *vol.*)

By the charter of incorporation of the Clockmakers' Company, David Ramsey was elected the First Master, and Henry Archer, John Wellowe, and Sampson Shelton were the First Wardens. The Company, from their establishment in 1631, having no hall, held their meetings at some tavern in the City. Their last meeting before the fire was held on August 20th, at the "Castle" tavern, in Fleet Street, and the first meeting after on October 8th, 1666, at the "Crown" tavern in Smithfield. After the fire the "Castle" tavern was rebuilt, and in October the obituary of that month records the death of Sir John Tash, Knight, Alderman of Walbrook Ward, who formerly kept the same tavern, and was one of the most considerable wine merchants of London. He was then in the sixty-first year of his age, and commonly reported to be worth £200,000. The company tried very hard for a livery for many years, and upon one occasion, when they petitioned for it to the Court of Aldermen, there was a very long discussion thereon, and upon a division the twenty aldermen present voted as follows—for, six; against, twelve; neuter, two; consequently the petition was again rejected. This was on July 11th, 1749; but a few years later the Company succeeded, and on Lord Mayor's Day, November 9th, 1767, at the inauguration of the Right Honourable Thomas Harley, brother to the Earl of Oxford, as chief magistrate, we are told in a newspaper of the following day that the Tin-plate Workers' Company and the Clockmakers' Company joined the Lord Mayor's procession yesterday for the first time since they were made livery companies, and made a genteel appearance. The Company is strictly a trade one; it is governed by a Master, three Wardens, and twenty-eight Assistants, chosen out of the fellowship. They have no hall, their meetings being held at the "London Tavern," where they have several paintings which were presented to them by old members. The Company has a lending library, rich in English and foreign works on horology and the allied sciences, with a printed catalogue, published in 1830, and a cabinet of specimens of watches, containing many varities, also of watch and clock work, illustrative of the progress of horology from its commencement. The Company's motto appropriately runs, "*Tempus rerum imperator*" (Time the governor of all things.")

(*To be continued.*)

The Order of the Crown of India.—The jewelled badge of the Order of the Crown of India is composed of the imperial cipher "V.R. and I.," in diamonds, pearls, and turquoise, within a border of pearls, and surmounted by the Imperial Crown. It is worn on the shoulder, pendent from a bow of pale blue watered silk ribbon, edged with white.

TRADE RECIPES, &c.

To Tell when the Lever Pallets are of Proper Size.—The clear space between the pallets should correspond with the outside measure, on the points, of three teeth of the scape wheel. The usual mode of measuring for new pallets is to set the wheel as close as possible to free itself when in motion. You can arrange it in your depthing-tool, after which a measurement between the pivot holes of the two pieces, on the pillar plate, will show you exactly what is required.

To Put Teeth into Wheels.—Make a hole through the plate of the wheel immediately below the point from which the tooth has been broken. Let its diameter be a little greater than the width of a tooth. Next, with your tooth-saw, cut down where the tooth should stand till you come into the hole. You then dress out, with a head upon it, a piece of brass wire, till it fits nicely into the cut of the saw, with its head in the hole. With a fine graver you then cut a crease into the wheel plate above and below, on either side of the newly fitted wire; after which, with your hammer, you cautiously spread the face of the wire until it fills the creases, and is securely clinched or riveted into the wheel. This makes a strong job, and one that dresses up to look as well as any other.

To Weaken the Hair-Spring.—This is effected by grinding the spring down. You remove the spring from the collet, and place it upon a piece of pivot wood cut to fit the centre coil. A piece of soft steel wire, flattened so as to pass freely between the coils, and armed with a little pulverised oil-stone and oil, will serve as your grinder, and with it you may soon reduce the strength of the spring. Your operations will, of course, be confined to the centre coil, for no other part of the spring will rest sufficiently against the wood to enable you to grind it, but this will generally suffice. The effect will be more rapid than one would suppose, therefore you will watch carefully, or you may get the spring too weak before you suspect it. Another and perhaps later process is as follows:—Fit the collet, without removing the spring, upon a stick of pivot wood, and having prepared a little diluted nitric acid in a watch glass, plunge the centre coils into it, keeping the other parts of the spring from contact by holding it in the shape of an inverted hoop skirt with your tweezers. Expose it a few seconds, governing the time of course by the degree of effect desired, and then rinse off, first with clean water, and afterwards with alcohol. Dry in the sun or with tissue paper.—F. Kemlo.

Chinese Silver.—65·2 parts copper, 19·5 zinc, 13 nickel, 2·5 silver, and 12 cobalt of iron.

To Mend Amber.—Smear the parts which are to be united with linseed oil, hold the oiled parts carefully over a small charcoal fire, a hot cinder, or a gaslight, being careful to cover up all the rest of the object loosely with paper; when the oiled parts have begun to feel the heat, so as to be sticky, pinch or press them together, and hold them so till nearly cold. Only that part where the edges are to be united must be warmed, and even that with care, lest the form or polish of the other parts should be disturbed; the part joined generally requires a little re-polishing.

How to Carve Cameos.—Take the common helmet or the red helmet shell (those shells whose inner surface is pink or dark-coloured are most suitable), cut them into squares with a lapidary's mill, round off the corners, and shape them into an oval on a wet grindstone. Fix the enamel side on a short stick with jewellers' cement; grind off the brittle surface; sketch the subject with a black-lead pencil; cut the subject with engravers' tools, namely, a chisel, tool to clear the bare places, a lozenge-shape for forming the subject, and a scraper, made of a three-angled file, ground off taper to the point, for cleaning the enamel surface round the subject, and also for forming the lineaments and other delicate parts. The colour in the cheeks and hair is produced by leaving the layer of coloured shell on those places. The stick must be grasped in the left hand, and held firmly against a steady bench, and with the tool resting in the hollow of the right hand, dig away the shell. A convenient length for the tools is three inches and a half; they must be kept in good condition to work with accuracy. The cameos are polished with a cedar stick, or a piece of cork dipped in oil of vitriol and putty powder, and cleaned with soap and water. Mother-of-pearl is carved in the same way.—E. Spon.

The latest "test" for diamonds is stated to be "double refraction." Look at a needle point or small hole in a card through a transparent stone, and the object will appear double. This is the case with all white or colourless gems except the diamond, which never exhibits double refraction.

Pearls will never tarnish and lose their brilliancy if kept in dry common magnesia, in lieu of the cotton wool used in jewel cases.

How to Test Diamonds.—Mr. F. W. Streeter, the well-known London jeweller, in a letter to the *Times*, says already a panic seems to have been created by the report of frauds in connection with imitation jewellery and diamonds known as the "Waterkloof." Mr. Streeter says it may allay some misapprehension if persons who have recently purchased diamonds of which they have any doubt would submit them to a very simple test—viz., the file. By drawing across the surface of any imitation diamond a small steel file, an effect is produced as highly detrimental to the spurious as it is satisfactory to the genuine article. To the uninitiated no better test presents itself.

Galvanising.—Small articles are galvanised by being dipped in muriatic acid and dried in a reverberating furnace, next thrown into zinc covered with sal ammoniac, left for a minute, and taken out slowly with a skimmer. To separate them, they are placed in a crucible surrounded with charcoal powder, then heated to redness, and shaken about till cold.

Tula Silver.—The product known as Tula silver, from the name of the town in Russia in which it is prepared, is now, it is stated, made on a large scale by Zacher and Co., of Berlin, who have succeeded in discovering the secret of the composition. Tula silver, a sort of niello, is prepared by them in a mass consisting of 9 parts silver, 1 copper, 1 lead, and 1 bismuth. The latter metal has been wanting in most attempts to make Tula silver. The metals, in the above-given proportions, are melted together and saturated with sulphur, the mixture giving a metal possessing the peculiar metallic blue tint often called steel blue.

QUERIES AND ANSWERS.

S. W. (W.)—Thanks for your communication. The method you speak of is the result of practical experience in the workshop, but applies, as stated, only to common watches. As regards your expectations, they shall not be disappointed.

S. W. (Birmingham)—Clock-weights will take a beautiful finish if rubbed with a rag previously dipped in stearin oil, and then polished with a dry rag and Nienna lime.

Prices Current for Gold and Silver.—Value Given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver, 4s. 6½d. to 4s. 9d. (variable according to quantity).

Maori Jewellery.—A New Zealand contemporary supplies the following:—In Napier there lives a lapidary who is almost entirely supported by the natives. They find greenstone, and take it to him to cut and polish, and manufacture into native ornaments. So large is his trade that he has to employ steam to do the work.

NOTES ON THE GOING-BARREL,

ITS STOPWORK, AND THE PATENT SLIDING CLICK.

THE belief still clings in certain quarters that to ensure accurate timekeeping in a watch, a fusee and chain for equalising the power of the mainspring are absolutely necessary. The object of these notes is, in the simpliest language, to show how such a belief gained its hold, and how at the present day, when judged experimentally and as a matter of fact, there is absolutely no foundation for it.

In the days of our grandfathers this belief was universal—what is more, it was, as will be shown presently, a true belief, or so generally true that the limited exceptions to the rule either had not been detected or were not generally known.

But, it is asked, if it was true then, why not now?

This apparently difficult question admits of a very simple answer, and it is this—Because the circumstances of the case are now altogether changed. A few words will suffice to show how this is.

In the times referred to, the verge was *the* escapement of the day, the only one used for the watches of the then million; the cylinder and duplex escapements were, it is true, in limited use, but only for the "watches of precision" of those times, and so far as we know, the practical independence which both these escapements possess of a fusee and chain was undiscovered, probably unsuspected, whilst the lever escapement afterwards "patent"-ed as a "rack," and subsequently improved by a "detached" lever, lay only in germ in Graham's dead beat clock.

Now the verge belongs to the class of accelerating escapements, in which the balance (through the verge) is always in contact with the 'scape wheel, and without any "dead" or stationary point in its action. Under such circumstances, the balance, upon the regular action of which the time of the machine depends, is influenced directly by the train; it feels and responds to every change of force in its motive power, and its regularity is precisely in proportion to the uniformity of the propelling force. In addition to this essentially accelerating quality of the verge escapement, it must not be forgotten that the small arc of vibration, always under half a circle, and the short balance spring, of about four coils, generally used in this watch, also tend to increase the inherent susceptibility referred to, and taken in combination give about all the conditions needful for as extreme a sensitiveness to variation in the motive power as could well be devised, even if ingenuity had purposely set itself to accomplish such an end.

No wonder that, under these circumstances, a belief in the absolute necessity of a fusee and chain arrangement to equalise the varying force of the mainspring, and so ensure respectable performance, became deeply rooted in the English mind.

But what, contrasted with this, is the condition of things to-day? Briefly put, it is, that instead of the verge we use now for our popular watch the detached lever escapement, a type of the *non*-accelerating class, in which every beat is independent of every other, the whole machine making a dead stop and a fresh start at every "tick." In the lever escapement, decidedly the most popular of this class, the balance is detached and uninfluenced by the train excepting at the momentary contact of a jewel pin, when the wheel is unlocked for its next "escape," and the balance gets its measured impulse for its fresh vibration, which in this escapement is over a circle, and is governed by a balance spring of eleven coils or more, the large vibration giving practical immunity from the disturbance caused by external motion, whilst the lengthened balance spring renders isochronal adjustment comparatively easy.

Under conditions like these, the worst rate of a lever watch with any sort of a going-barrel will prove to be better and more uniform than the best rate of a verge watch with whatever equalising arrangement may be added. But when it is borne in mind that in the watches made by the English Watch Company special provision is made for equal tension, by the use of a mainspring of unusual length and lightness; that the relative proportions of balance and balance spring are so nicely observed that isochronism—equal time—whatever may be the vibration of the balance, is attained, and, in addition, that the 'scape or pallet wheel has teeth of a shape proved by experience to be peculiarly adapted to the going-barrel train, whilst in the important points of freedom from the pallet striking the back of the tooth, power of retaining oil on the action parts, the non-liability to injury either from handling, wear, or by reversing the train to set hands, it is much to be preferred to the ordinary delicate straight tooth wheel still commonly used in fusee watches—these things remembered make it in any case presumptively evident that all the essentials of accuracy are contained in a properly constructed going-barrel watch.

As, however, the object of these notes is to carry the subject altogether beyond the region of presumption, and to show to those who hitherto have felt scruples in putting going-barrel watches into their stock how totally unfounded those scruples are, attention is directed to the following circumstances, which the experience of every shopkeeper will confirm, and which have, too, a direct bearing in illustration of the argument.

The first is the excellent results obtained, and the staple position in our market that has for many years past been held, by Swiss watches, particularly the better class of work. No shopkeeper, whatever reservation he may make as to their frailty or lightness, ever hesitates to speak well of them as timekeepers, yet it is well known that the Swiss manufacturers fifty or sixty years ago had all our present traditions, and made their cylinder watches for the English market with fusee and chain; they are wiser now, and have abandoned it. We soon shall be as wise as they!

Another experimental proof of the essential excellence of the going-barrel principle, which is also within the knowledge of every intelligent shopkeeper, is, that whether of English or foreign make, keyless watches now uniformly have going-barrels. Every retailer knows that quite as much, certainly *not less*, accuracy is expected by the wearer from a keyless watch as from any other, and he also knows that when he sells an adjusted and rated keyless watch it gives as great satisfaction, that is, IT GOES AS WELL as any other make, and THAT, after all, is the very thing that a watch is valued for.

If, however, a doubt yet remains, attention need only be directed to the distinction attained in the International Chronometer trials at Geneva, where in repeated instances up to and including the year 1877 high distinctions and several first prizes have been won by chronometers with going-barrels, in competition with the productions of the most eminent English manufacturers of the traditional school.

Surely the principle that is good for the finest foreign work, for the costly English keyless watch, and the marine chronometer itself, upon whose accuracy not only vast property, but human life itself, is staked, cannot but be sufficient—nay, cannot but be *the best* for the ordinary purposes of to-day.

To sum up, there can be no doubt that the going-barrel, with its arrangements as now made by the English Watch Company, is for timekeeping purposes fully equal to the fusee principle.

It is also simpler, more rational, less likely to get out of repair, and therefore more creditable to the vendor and more satisfactory to the wearer than the now unnecessary fusee and chain arrangement, which only holds its ground on the basis of a tradition, which, as has been shown, does not apply to present circumstances, and the retention of which in the watches of to-day is an illustration of nothing else than the exceeding vitality there is in a thoroughgoing prejudice.

Having disposed of the going-barrel *versus* fusee and chain, a few lines are required for the consideration of the related subjects of

STOPWORK, and of THE PATENT SLIDING CLICK.

Where a chain forms a part of the winding mechanism of a watch, some arrangement by which a "stop" is interposed at a given point is indispensable; neglect this, and the chain snaps at every winding.

Luckily, with the fusee movement, this safeguard can be applied quite readily, and if it is well made, the stopwork of the fusee watch is durable enough to satisfy all reasonable requirements.

With the going-barrel, however, the application of a reliable stopwork is a problem still unsolved.

There have been many contrivances intended to meet the difficulty; speaking broadly, however, they have all gone out of use except the Star Wheel and Finger Piece, so well known in Swiss watches. It may be inferred that the practical monopoly enjoyed by this stopwork is a case of "survival of the fittest," and a proof that with all its faults it is the best yet devised, but that it has no claim to be regarded as a perfect arrangement is notorious. Every experienced watch jobber will admit that a large number—perhaps a fourth, or in some districts a third—of the Swiss watches in wear are *without* the protection it was designed to ensure; not that they never had stopwork, but rather that it has broken down, and been taken away, for nothing is more common than for the affair upon the slightest strain to become a "stop" work indeed to the whole watch, and when this occurs it is, amongst a large class of repairers, quite an ordinary thing to bodily remove one of the pieces (generally the star wheel), as the shortest way to get over the difficulty, and make the watch go at all; that this condition of affairs is not overstated will be confirmed by every practical man in the retail trade.

Here it will be well to mention the advantages sought to be attained by the use of stopwork to the going-barrel. They may be summed as an effort—

1st. To obtain an approximate adjustment of the mainspring (by the E. W. Co. this is done by the use of a light, long mainspring).
2nd. To prevent the tearing away of the barrel hooking.
3rd. To prevent blocking, overwinding, or overstraining of the mainspring.
4th. To prevent the undue acceleration of the escapement whilst the mainspring is fully wound up and on the strain.

Now, whilst the stopwork is in perfect order these objects are no doubt practically attained, but—and a very important qualification this is—when the least strain or derangement occurs, as has been pointed out, the watch stops, and is either despoiled of the stopwork altogether, or has, with whatsoever success may be possible, a new one fitted. Of course the inventive faculty of modern watch manufacturers has been directed to overcoming the drawbacks involved in this weak point of the going-barrel, but hitherto they have gone no further than by the adoption of various improved modes of hooking in the mainspring—notably the pivoted brace—to secure the second of the desired advantages named above.

This hooking, at once simple and effectual, is perfectly secure from the risk of tearing away, the pull of the spring against the rivet being under all circumstances in a direct line; but it does not meet, nor does it pretend to, the danger of "blocking"—that is, winding the spring so tight and close that it binds itself, and remains coiled up and immovable. The other serious fault of undue and violent acceleration of the escapement is also left unremedied, together with whatever of risk to the mainspring may be involved in a daily overstrain. Nevertheless, the balance of advantage in favour of stopwork has been judged to be so small that the designers of the American watches have almost entirely abandoned it, preferring the limited but certain gain, already referred to, to the complication, the risk, and the insecurity of every known barrel stopwork.

By a recent invention, however, known as "Haseler's Patent Sliding Click," the whole of the weak points hitherto existing are completely met and covered, and the going-barrel, with pivoted brace and patent sliding click, may now be considered in the point of safeguards as fully equal to the old stopwork; whilst in simplicity, strength, certainty of action, and impossibility of failure or breakdown, it is immeasurably superior.

The principle and action of this beautiful little arrangement are so elementary that it is a matter of wonder it has never been hit upon before.

The principle is, that if provision is made for a certain amount of "give" or return in the ratchet work, it will be alike impossible to leave the mainspring on the strain or to block it; and, consequently, the disadvantages of over-winding on the one hand, and excessive action of the escapement on the other, vanish together; and, in point of fact, this is exactly what does happen.

The application is simply this: that instead of the click having a round hole to receive the pin or screw on which it turns, the hole is elongated, or is what is technically called a slot, whilst the click spring is so formed that its action always throws the click forward, at the same time that it presses the point downward to engage in the ratchet teeth. In operation—supposing the key to be upon the winding square, and turned forward to wind the watch up—the click does not immediately begin to rise over the teeth of the ratchet, but first follows the forward movement of the ratchet for a certain distance, this distance being regulated by the length of the slot in the click. Having reached the end of its sliding limit, its ordinary action as a click begins, and continues as long as the forward action of the key is maintained. When, however, the power is taken off the key, and the mainspring instead of the hand of the winder comes into play, the arbor and ratchet return and the point of the click being engaged in the ratchet, it is carried or pushed backward just as much as it had gone forward in the action first described, this return affording the relief to the mainspring which is required to effect the objects numbered 2, 3 and 4, and hitherto sought to be attained by the use of stopwork.

This sliding action, so simple, so certain in its protective quality, is its value, and this principle, in all its applications to going-barrels both of watches and clocks, is now patented by; and is the sole property of, the English Watch Company. After most exhaustively testing the invitation on several thousands of their watches, under all possible circumstances, and with unqualified success, they have adopted it as a radical cure for all the ills and shortcomings to which the going-barrel, either with or without stopwork, has hitherto been subject, and by these notes they desire to bring it and their manufactures generally more directly under the notice of the trade, whilst at the same time they have been enabled in a familiar way to show the groundlessness of the stock objections to a construction of watch which, whatever may hitherto have been thought or said to the contrary, is unquestionably laid out on the lines, and manufactured on the system that entitles it without egotism to be called not merely the watch of the day, but also the watch of the future.

CORRECTION OF CLOCKS BY ELECTRICITY.

A Paper read before the Royal Scottish Society of Arts by F. James Ritchie, Edinburgh.

THE growing appreciation of the value and the importance of correct and coincident time in all relations of commercial life, and the necessity of observing punctuality in connection with the railway, postal, and telegraphic arrangements, will, I trust, form a sufficient apology for occupying the society for a short time, while I endeavour to indicate some of the methods which have been employed to attain these results, and will I hope tend to a more extensive publication of exact time than has hitherto been accomplished throughout the country, and especially in our great commercial centres.

To obtain the first of these requisites, namely correct time, we have situated in Greenwich, Liverpool, Edinburgh, Glasgow, Aberdeen, and some other of the principal towns, observatories provided with clocks specially constructed for astronomical purposes, being fitted with compensation pendulums and delicate refinements of mechanical appliances for preventing the changes in temperature and barometric pressure, to which we are so subject, affecting their timekeeping qualities. These clocks must be compared day by day with the transit of the sun, or some of the so-called clock stars, and have their errors eliminated from time to time, by a thoroughly trained staff of observers. The errors may be small, but for astronomical purposes a small error represents a large amount of space, and in nautical life the danger of a wreck or a lee shore.

Having obtained the correct time in this way, it becomes not the less important for the general public to secure coincident time in all our clocks, a matter which has not yet received the attention which it deserves. Shortly after the introduction of railways, it became apparent that coincident time must be observed throughout the land, and soon led to the introduction of Greenwich mean time as the standard in Great Britain, instead of each town using its local time. Even the short distance between Edinburgh and Glasgow led to a difference of nearly five minutes in our watches, and at the present time leaving Greenock at nine o'clock at night, with our watches set to Greenwich time, we find ourselves at four o'clock next morning some twenty-five minutes too early by the clocks in Belfast, where Dublin time is recognised as the standard for Ireland.

Consequent on the introduction of the uniform time, and to meet the growing demands, Greenwich Observatory early initiated a system of time signals, which were and still are sent to all the principal towns both in Great Britain and Ireland. At 10 a.m., and again at 1 p.m., a chronofer in the London Post Office is put in connection with the Greenwich mean time clock, and automatically repeats its time along the ordinary lines of telegraph wires which are by the apparatus cut off from the instruments. These signals consist of the deflection of a small magnetised needle for about twenty seconds before these hours, followed by the sudden reversal of direction in the needle, this change indicating the exact hour. The annual charge, however, proves obstructive to anything like general adoption, even by watchmakers, while, from its very nature, it can only be made available to a few, and entirely beyond the reach of the general public.

Previous to 1840 many attempts were made to cause clocks to move in unison with each other, but without success. We read of one high in rank, who spent much money, and occupied his time for several years, in trying to make a few clocks in his residence strike in unison with each other, but could not secure this, even for a few days. With the introduction of electricity, however, and its application to horology, the problem was gradually solved, and, in course of a few years, any number were made, not only to strike, but even their pendulums were made to vibrate in complete unison with each other, and with the normal clock, and this unceasingly, so long as the controlling power was maintained. The most notable, and the one attended with the greatest success, is that system of controlled clocks patented by Mr. R. L. Jones, having for its groundwork the electro-magnetic pendulum constructed by the late Mr. Alexander Bain in 1843, and which is well known in this city in connection with our daily time signals, the unvarying accuracy of which for the past eighteen years is sufficient test of the value of the system. This controlling system has already been before the society, on the 22nd July, 1861, and again on the 28th April, 1873, so that we only now refer to it in passing. Nor is it necessary that good clocks be employed, as very indifferent, nay, even rough and coarse clocks, when controlled in this way, are rendered as perfect in their performance as the clock by which they are governed. The principal working clock in the Royal Observatory on the Calton Hill, or the clock by which transits are observed, and the rate of the mean time clock adjusted, is a good example of the power and value of the system, being more like in construction and quality of workmanship to a windlass used by masons for hoisting stones than anything to which we apply the name of clock, but useful from its loud beating of each second by a small hammer upon an anvil, its beat corresponding in unvarying precision with the governing or normal clock. We can even go a step further, by saying that clocks which are not clocks at all, but merely trains of wheel-work, for recording the vibrations of a pendulum, having no impelling power in themselves, are equally effective when corrected in this way. Such are the sympathetic clocks described in a paper read before the society 28th April, 1873, and with which all may be familiar as exemplified by the clock in front of the General Register House, and one in the Museum of Science and Arts, besides those at the gates of the Albert and Victoria Docks in Leith.

For the past eighteen years my attention has been much given to the system of reproducing on clocks, at a less or greater distance, the time as recorded by some standard or observatory clock, and indicating the same to a fraction of a second on dials more or less exposed to public view, and also in connection with the more public system of time-balls and time-guns; but latterly it has been forced on my notice that the commercial value of time is really measured by minutes, and not by seconds, as in astronomical establishments, as even our central telegraph offices only record the minutes and hours, to the entire exclusion of seconds, and more especially this fact being evident from probably 99 out of every 100 clocks in use have not even a seconds hand to indicate these smaller divisions, but are only provided with a minute and hour hand; and the necessity and value of some simple, effective, and inexpensive method of removing the errors, and setting to time at stated intervals such clocks as are in use in public and private offices, and even in our larger clocks at railway stations and steeples, causing them to indicate coincident time with the standard or observatory clock and with each other, led me to consider the matter in a more general light.

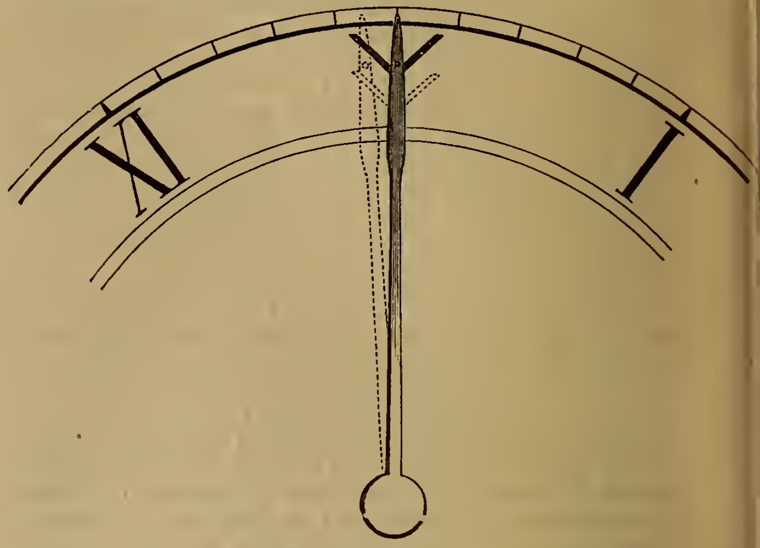
I need not enlarge on the advantages which would be obtained by the adoption of such a system, and the comfort, as well as profit, to the public at large arising from all clocks indicating similar time, for this must be patent to all, but shall devote the remainder of this paper to our experience and success in accomplishing this end, and in giving an indication of what has been done by others in the same field.

About thirty-six years ago, the late Mr. Alexander Bain, well known in this city by the large-sized electric clock projected from his premises in South Hanover Street, and whose death in January of last year was noticed in the *Scotsman* of the 10th of that month, proposed a method of setting the minute hands of ordinary clocks to correct time every hour in a most simple and effective manner, the importance of such a system of correcting clocks, and securing coincidence amongst them, being so apparent to his master mind at this early stage that nearly the first introduction of electricity to horology was devoted to this end. Whether he ever put his system into actual operation, or to what extent, I have been unable to learn; but the plan is noticed in a pamphlet published in 1843 "On the Application of the Electric Fluid to the Useful Arts," and is fortunately illustrated by a diagram and description with references. An electro-magnet was placed behind the dial of the clock to be corrected. The armature of the magnet carried a rod ending in a fork or "V" immediately above the figure XII. A pin projected back from the minute hand was so placed as to clear the arms of the V when the armature was in its normal position, and forced to occupy the angle V when by the attraction of the magnet the keeper and rod were drawn upwards. Exactly at the last or sixtieth second of the hour shown by the normal or regulating clock, contact was automatically made by it with a battery in connection with the line wire, so rendering the electro-magnet active and attracting the armature, forced the V against the pin in the hand, forcing it forwards or backwards into the angle of the corrector, if within range of its action.

The simplicity of this application must strike every one both from its direct action and fewness of mechanical parts, and the remark which was circulated in the leading London paper, and from it copied into the *Scotsman* of the 24th January last year, will be acknowledged by all to be most unjust to the memory of Mr. Bain. The paragraph runs thus—"In regard to Mr. Bain's invention, it is quite true that he very wisely went at once to the setting of the hand, but he attempted it so clumsily that it was a total failure." Nor is it only an affair of the past, but a few weeks since it again appears in other publications characterised as a "method exceedingly crude, and never adopted in practice." These remarks evidently emanate from the same source, and are equally unworthy of their authorship and false to Mr. Bain's ingenuity. Regarding the expression "never adopted in practice," it is remarkable that the system of clock correction by hourly currents of electricity, like the long-neglected electro-chemical printing telegraph invented by Mr. Bain, should only at the close of this great inventor's life be brought prominently before the public, the Post Office being at that time experimenting with his invention as being more rapid in operation than the more recent applications; showing evidently that Mr. Bain's discoveries were disclosed fully thirty years too early for the demands of the public, or the advance of scientific education.

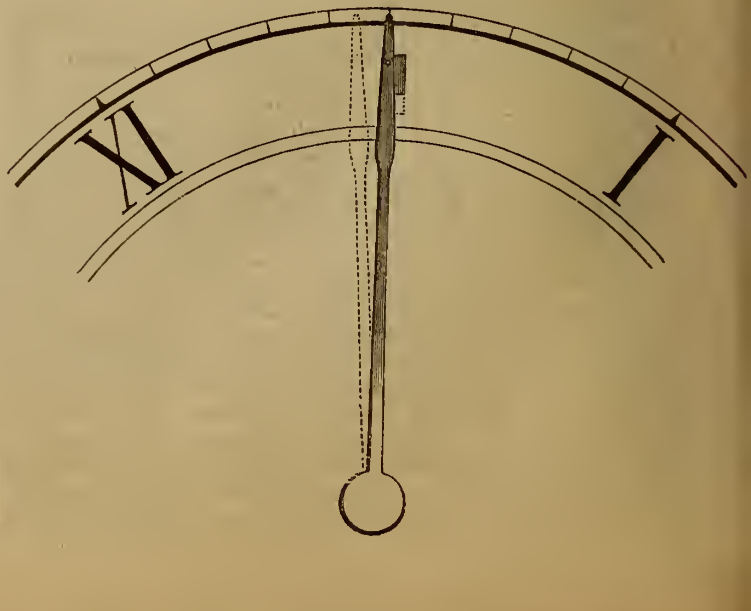
In the paper referred to previously, I took notice of Mr. Bain's proposal, and the mention therein made was no doubt the origin of a patent taken out by a London firm, who adopted, to my mind, a much more cumbrous and intricate arrangement to accomplish the same end, by means of a bar attached to the keeper, carrying two projecting pins which act in slots in two other levers, from the ends of which two other pins are projected, by which the minute hand, or rather a block upon the hand, is caught and forced, if sufficient power is applied, to occupy the position required; thus performing the same work as Mr. Bain did with his simple V, moved directly by the armature of the magnet, and introducing a great amount of mechanical work, with considerable friction to be overcome before the requisite correction is even applied to the clock hand, necessitating great battery power, and consequently increased liability of error and expense of maintenance over that of Mr. Bain.

Another London firm improved still further on the system, by introducing some even more elaborate apparatus, so as to render it applicable to larger clocks, and, as he expresses it, to "synchronise the hands of turret clocks or other large clock-work." This patent is just printed, and has come into my hands only last week. The apparatus consists of a pair of levers acting upon the set or false minute hand of a turret clock by the shorter end. The longer end is characterised as of a zig-zag form consisting of two inclines, which again cross each other. A long lever, provided with a very heavy weight near its extremity, carries a strong pin by which it is gradually raised during nearly the whole hour by a snail or cam upon the minute wheel arbor, the pin passing up between the zig-zag levers and opening them out. These fall again into position when the lever is raised to the top. A catch is carried by the armature of the magnet, which engages with the end of the long lever, and retains it in position when relieved by the snail about five minutes before each hour. On the arrival of the current, the catch is withdrawn, and allows the lever to fall. In its descent the pin opens up the zig-zag levers, and causes the shorter ends to strike, one at each side of the minute or set hand, as, so it is supposed, to force the hands to indicate coincident time with the normal clock, for which purpose the connection with the clockwork must be left sufficiently loose. Of course the clock has to raise this weighted lever each hour, and is thus made to provide for its own correction, and supply the force to strike itself. We cannot say more than it may be ingenious, but reminds one very much of a pair of snuffers, and have no doubt would, if applied to some steeple clocks, speedily snuff them out of existence.



Having been often pressed to undertake the correction of ordinary clocks, and appreciating the value and advantage of supplying coincident time in office and public clocks, we resolved to adopt some system which might prove generally applicable, and embody extreme simplicity in construction and small expense in battery power, combined with certainty of action, and had several clocks fitted and under correction for some time, with an adaptation of Mr. Bain's V. Instead of attaching the V directly to the armature, and requiring a corresponding amount of motion, I introduced a lever with the V at a greater distance from the fulcrum, and thus reduced the working distance of the armature from the poles of the magnet.

This plan we wrought for some time with considerable success, but experience showed one or two imperfections to exist in the application, placing it at a disadvantage. Nearly all the clocks to be operated on are not provided with maintaining power work, or, more simply, do not go while being wound up,



and in consequence the wheel-work went backwards while the operation was being performed. Thus, if say ten seconds were occupied in winding, the clock would be twenty seconds slow after the operation. To correct this error, the arms of the V must be made to cover nearly a whole minute, necessitating either a very obtuse angle in the V, and considerable battery power to work it, or a more acute angle with longer arms and increased motion, also requiring greater electro-magnetic force to attract from the increased distance of the armature from the poles of the magnet. Another and much more serious disadvantage arose from the necessity of leaving the hand of the clock very loose in its connection with the wheel-work, to allow of its being moved by the current. In the case of small clocks, such as in offices, this did not so much matter, but in larger ones, such as at railway stations, whose hands are not protected by glass in front from the force of the wind, the necessity of more secure attachment is apparent.

To obviate these defects we substituted the "I" or block system, by removing one limb of the V, and placing the other at a smaller angle to the pin on the hand, and giving the clock at the same time a very slight gaining rate. Instead of a momentary signal or current we adopted one of 15 seconds' duration, commencing at the 59th minute 45th second of each hour and ending at the 60th second, or the exact hour of the normal clock. The adoption of this method at once enabled us to decrease the battery power very materially, as the distance to be moved by the block is very small, just sufficient to take hold of the pin, thus increasing enormously the attractive power of the magnet. We were also able to secure the hand more firmly to the wheel-work, and consequently larger clocks could be placed in circuit, and treated with safety.

Further difficulties, however, were encountered, and forced us to reconsider the whole matter. Many of the hands of the clocks were light, and their elasticity was in some instances so great as to bend and eventually overleap the block by the force of the wheel-work, thus getting in advance, and so out of correction. The friction of the hand on the stop, being pressed with all the force of the wheel-work, occasionally prevented the stop from falling out of action at the cessation of the current, unless it was loaded or placed at a greater angle, in either case requiring slightly increased battery power to raise or retain the block in its position.

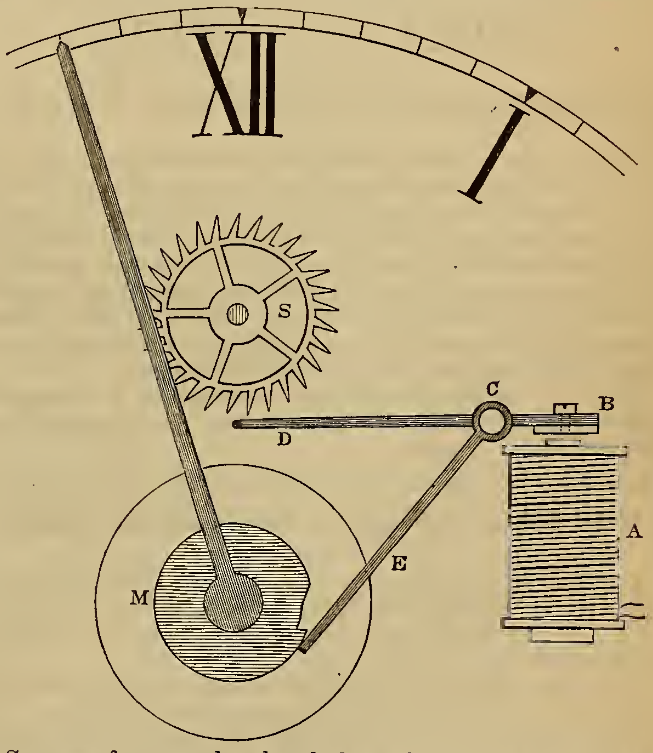
We therefore went a step further, and have now succeeded in obviating all these defects, rendering the principle applicable to all clocks, however large and cumbrous, having pendulums of any length, and dials of any number, size, and exposure, retaining the utmost simplicity of action and lightness of mechanical parts, together with a minimum of battery power and certainty of action.

Before, however, explaining the construction of this "ne plus ultra" system, I would mention a plan to which I shortly alluded in the same paper with Mr. Bain's (28th April, 1873), which was introduced by Mr. Walker, of the late Electric Telegraph Company, and in actual operation for some years in the telegraph offices of principal towns in Great Britain. An electro-magnet within the clock case was introduced into the London circuit by a switch, a minute or so before ten o'clock each morning, and being excited for about 30 seconds before ten by a current from the London office, retained upon its armature a stop in front of an arm on the scape wheel, thereby arresting its progress till the armature was allowed to drop by the cessation of the current at the exact hour, and so adjusting the clock to within two seconds of correct time once a day.

This arrangement, it will be seen, is only available for clocks with seconds pendulums, or for such clocks whose scape wheels make a certain complete number of revolutions in an hour or betwixt the intervals of correction; and for that class of clocks which indicate seconds, we at once adopted the principle on the introduction of our hourly currents, and have had several in action both in Edinburgh and Leith for many months.

I now invite attention to the system just introduced, and presently worked by us, and to which we are gradually assimilating those at first furnished with the "I" or block method.

The clock to be corrected, as in the previous systems, is caused to gain slightly, or rather is regulated not to lose time; the amount of gaining rate is immaterial, and may be one second in a week or 40 minutes. The minute hand will therefore arrive at the hour less or more too early, and our aim is to arrest its progress to that extent. The electro-magnet A is excited 15 seconds before each hour by a current from the normal clock, and by its attraction on the armature B acting on the fulcrum or centre C, would raise the lever D, with the stop pin at its extremity, into contact with the scape wheel S, thereby arresting its motion till the cessation of the current. A disk M, carried by the wheel to which the minute hand is attached, here performs a most important part in the arrangement, as by it the scape wheel detent is prevented getting into action with its teeth until the minute hand arrives at the 60th division of the dial, when a notch in the periphery of the disk, corresponding to that division, allows the lever E to pass, and with it the other arm D carries its stop pin into action with the scape wheel and arrests its progress. Immediately the current is cut off by the normal clock the magnet ceases to attract its armature, the preponderance of the levers causes them to all out of action, and the clock is started for another hour.



Suppose, for example, the clock would gain two minutes a day if left to its normal rate, equivalent to five seconds each hour, the action would be this—the electro-magnet would be excited at the 45th second by the governing clock, but could not draw the stop lever into contact with the scape wheel until the minute hand pointed to the 60th division on the dial, which would be at the 55th second. Then the levers would be immediately liberated, and would arrest the scape wheel, thereby stopping the clock, and retaining it till the cessation of the current at the 60th second, thus setting the clock automatically to correct time. An error of even five minutes a day could be corrected by an hourly current of 15 seconds duration, without running any risk of stopping the clock entirely, as the momentum of the pendulum should maintain its vibration for more than that time.

(*To be continued.*)

THE

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SPECIAL NOTICE.

Commencement of the Fourth Volume.

WITH the present number this Journal enters upon its fourth year of publication, and we take advantage of the occasion to thank our numerous subscribers for their patronage. It is very gratifying to be able to state that our endeavours to supply an organ worthy of the trades we represent have not only been recognised, but rewarded with substantial support. We shall in the future, as in the past, spare no effort to deserve the confidence reposed in us, and neglect no opportunity to further the interests we have undertaken to advocate.

Those of our subscribers whose subscriptions have expired will confer a favour by renewing at once, so as to secure due delivery of the Journal.

THE HALL-MARKING OF WATCH CASES.

AT a special meeting of the Council of the British Horological Institute, held June 17th, Mr. John Jones, F.R.G.S., V.P., in the chair, the following resolutions were adopted unanimously:—

That the Hall-mark of the Goldsmiths' Company has not been regarded by the trade as a trade-mark for watches.

That the pretext of declaring the Hall-mark to be a trade-mark would give to one section of the watch trade a monopoly at the cost of all the rest. The proportion of labour in the production of a watch may be divided into one-tenth for the case and nine-tenths for the works.

The interchange of parts of watches between English and foreign manufacturers is already sufficiently extensive, that any restriction would greatly impede the watch trade in this country.

The proposed restriction would stop the production of a branch of the manufacture where the movements are of a complicated character, and wholly or partly of foreign manufacture, to which now English cases are applied.

That the suppression of fraud on the public by the substitution of foreign watches for English, would not be effected by the proposed Bill, inasmuch as foreign movements could still be put into English-made cases by the unscrupulous.

PATENTS.

Applications for Letters Patent.

2184. OLIVER PRUST MARTIN, of Edgbaston, in the county of Warwick, jeweller, for an invention of "Improvements in solitaires, studs, sleeve-links, and other like articles."—Dated 31st May, 1878.

2256. WILLIAM DAVID BOWKETT, of Leeds, in the county of York, surgeon, for an invention of "Improvements in thermometers."—Dated 6th June, 1878.

1783. JOSHUA WILLIAM EDMUNDSON, of 35, Capel Street, Dublin, Ireland, merchant, for the invention of "Improvements in electric and electro-pneumatic bell indicators."

2283. DANIEL AZRA ASHLEY BUCK, of Worcester, in the county of Worcester, and state of Massachusetts, in the United States of America, for an invention of "Improvements in watches."—(Complete Specification.)—Dated 7th June, 1878.

2331. JOHN BARNARD JACKSON and WALTER CHARLES PERRINS, of Birmingham, in the county of Warwick, jewellers and co-partners, for an invention of "Improvements in bars for Albert or Brequet chains."—Dated 11th June, 1878.

2381. ARTHUR CHARLES HENDERSON, of 6, Southampton Buildings, in the county of Middlesex, patent agent, for an invention of "Improvements in optical instruments, such as opera, field, race glasses, and telescopes."—A communication to him from abroad by Pierre Ferdinand Gérardin, of Paris, France.—Dated 15th June, 1878.

2441. LOUIS AUGUSTE GROSCLAUDE, of Genève (Suisse), manufacturer, for an invention of "An improved click and spring work."—Dated 19th June, 1878.

2467. CHARLES SHEPHERD, of Alexandra Road, Saint John's Wood, in the county of Middlesex, for an invention of "Improvements in electro-magnetic clocks."—Dated 20th June, 1878.

2478. THOMAS JOHNSON POTTER, of Clapham, in the county of Surrey, Master of Arts, for an invention of "Improvements in the construction of telescopes."—Dated 21st June, 1878.

Notices to Proceed.

686. ELIJAH ATKINS, of Birmingham, in the county of Warwick, manufacturer, has given notice in respect of the invention of "Improvements in fastenings for solitaires, sleeve links, and other like articles."

2283. DANIEL AZRA ASHLEY BUCK, of Worcester, in the county of Worcester, and state of Massachusetts, in the United States of America, has given notice in respect of the invention of "Improvements in watches."

Grants of Provisional Protection for six months.

2017. WILLIAM ROBERT LAKE, of the firm of Haseltine, Lake, and Co., patent agents, Southampton Buildings, London, for the invention of "An improved process of refining impure lead, and separating therefrom gold, silver, and other metals."—A communication to him from abroad by Nathaniel Shepard Keith, of Brooklyn, New York, United States of Amerioa, chemist and electrician.

Inventions Protected for Six Months on the Deposit of Complete Specifications.

2283. DANIEL AZRA ASHLEY BUCK, of Worcester, in the county of Worcester, and state of Massachusetts, in the United States of America, praying for Letters Patent for the invention of "Improvements in watches," was deposited and recorded in the Office of the Commissioners on the 7th day of June, 1878, and a Complete Specification accompanying such petition was at the same time filed in the said office.

Patents which have become void.

1928. THOMAS WILLIAM GREAVES, of Birmingham, in the county of Warwick, for an invention of "Improvements in solitaires."—Dated 26th May, 1875.

1945. LEANDER EATON, of Worcester, in the county of Worcester, and state of Massachusetts, United States of America, for an invention of "An improved method of, and apparatus for, regulating chronometers, watches, and clocks."—Dated 27th May, 1875.

2019. THOMAS GREAVES, of Birmingham, in the county of Warwick, jeweller, for an invention of "Improvements in the construction of solitaires and studs."—Dated 2nd June, 1875.

Patents Granted in Foreign States.

GERMAN EMPIRE.

1001. F. HOLZWARTH, of Cannstadt, for "A contrivance for fastening studs."—Dated 6th October, 1877.

1557. A. FRANKFELD, of Geneva, for "A pocket clock-work."—Dated 18th November, 1877.—Class 83.

1601. H. SCHMIDT-DOLNE, of Paris, for "Cuff-studs with overlapping bottoms."—Dated 8th January, 1878.—Class 44.

United States of America.

200,009. John F. Werner, of New York, N.Y., assigner to William C. Spellman, of the same place, for "Clock-advertisers."—Application filed 19th October, 1877.

5,660. William C. Greene and Co., of New York, N.Y., and Providence, R.I., for "Wire and coral jewellery."—Application filed 25th January, 1878.

200,380. Ovide Domon, of Bienne, Switzerland, for "Watch-cases."—Application filed 28th March, 1877.

200,379. Ovide Domon, of Bienne, Switzerland, for "Stem-winding and setting devices for watches."—Application filed 13th December, 1876.

200,533. James M. Hitchcock, of Michigan city, Ind., for "Escapements for watches and clocks."—Application filed 12th May, 1877.

200,539. John L. Hutchinson and Henry Dehouck, of Elgin, Ill., for "Watch plates."—Application filed 7th August, 1877.

5,667. Steinau Jewellery Company, of Cincinnati, Ohio, for "Jewellery."—Application filed 15th January, 1878.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Line, Walter Edward, 36, Cattell-road, Small Heath, Birmingham, late Carpenter-road, Lozells, near Birmingham, jeweller. June 5. G. Joyn, sol., New-street, Birmingham.

Masters, Philip Dnl. Francis, Axminster, jeweller. June 3. G. Hirtzel, sol., Exeter.

Lemmon, Chas., North End, Croydon, watchmaker. June 5. T. J. Pullen, sol., 1, Basinghall-street, and Croydon.

Plaskett, William, 538, Mile End-road, watchmaker. June 5. J. E. Dunn, sol., 1, Guildhall-chambers.

Prince, Edward, 59, Russell-street, Southsea, watchmaker and jeweller. June 1. G. H. King, sol., Portsea.

Fehrenbach, Gustave, Horsley-fields, Wolverhampton, watchmaker. W. A. Green, sol., Wolverhampton.

Harris, William Henry, East Dereham, watchmaker. June 11. Cooper & Norgate, sols., East Dereham.

Smith, Ross, Millom, Cumberland, watchmaker. June 7. Myers-Meakin and Hall, sols., Millom.

Newman, Abraham Benjamin, Soho Hill, Handsworth, jewellers' factor. June 21. A. Peet, sol., 83, Colmore-row, Birmingham. July 8 at 11.

Margoschis, Michael Samuel, Wynn-street, Birmingham, dealer in jewellery. June 17. A. B. East, sol., 35½, Cherry-street, Birmingham.

Whitaker, William, Gibbet-street, Halifax, watchmaker. G. Rhodes, sol., Halifax.

Shaw, James, Cheapside, Leicester, jeweller. June 17. Loseby and Brutton, sols., Leicester. July 8 at 3.

Trustees Appointed.

McKenzie, Jno. (Liq.), Downham Market, watchmaker, &c. Tr., H. Wright, Farringdon-road, London, tobacco manufacturer.

Dividends.

Jones, William A., & David Jones (Liq.), Pall Mall, London, and Brighton, jewellers. 1st div. 4s.; Stuart & Bennett, 37, Old Change, Cheapside.

Jones, William A., & David Jones (Liq.), Pall Mall, London, and Brighton, jeweller. 2nd div. 2s.; Stuart & Bennett, 37, Old Change, Cheapside.

Kingston, Jno. T. (Bkt.), Ramsgate, jeweller. 1st and final div. 9d.; R. W. Feast, at Harcourt & Macarthur's, 13, Moorgate-street.

Mendelssohn, Albt. (Liq.), Lime-street, Liverpool, jeweller. 1st and final div. 2s. 5d; C. Connor, 57, Ranelagh-street, Liverpool.

Adjudications of Bankruptcy.

Cohen, Jacob, Stock-st., Cheetham, jeweller. May 31. J. Gardner, sol., 1, Cooper-st., Manchester.

Dyer, Geo., trdg. as Dyer & Sons, 90, Regent-st., jeweller. May 16. J. C. Button & Co., sols., 6, Henrietta-st.

Dewar, Jsph. Danl., 280, Westgate-hill, Newcastle, late Worksop, jeweller. May 27. W. Taylor, sol., Newcastle.

Jay, Francis, Horncastle, watchmkr. and jwlr. May 28. W. T. Page, jun. sol., Lincoln.

Whitaker, Wm., Gibbet-st., Halifax, jeweller. May 29. G. Rhodes, sol., Halifax.

Turner, Geo., trdg. as H. Turner & Co., Branston-st., Birmingham, gilt jeweller. May 30. W. Fallows, sol., Cherry-st., Birmingham.

Williams, Chas., 314, Oxford-st., Stepney, jeweller, May 29. S. T. Cooper, sol., 88, Chancery-ln.

Wolfle, Ferdinand, 34, Walworth-rd., jeweller. May 20. G. Chipperfield, sol., 7 Trinity-st., Southwark.

Zolki, Marks, Rock-st., Sheffield, jeweller. June 6. Wake, Reg.

Dewar, Jsph. Daniel, Westgate-road, Newcastle, jeweller. Mortimer, Reg.

Garland, Jas., Grey-st., Newcastle, jeweller. June 20. At C. C. Newcastle, July 6 at 11½. Mortimer, Reg.

Dissolutions of Partnerships.

Davies, E. & G., Branston-st., Birmingham, gold ornament mnfctrs. Apr. 15.

Lewis, J. & D., 59 King's-road, Brighton, jewellers. Apr. 30. Debts by Jacob Lewis.

Pickford & Diaper, Ipswich, watchmakers, Mar. 25. Debts by Jas. Diaper.

Parker & Gall, 69 St. Martin's-ln., dlrs. in bullion jewellery, Apr. 11. Debts by Geo. Parker.

TRADE CATALOGUE.

Messrs. J. R. Williams and Son, of 100, Hatton Garden, London, E.C., so justly celebrated for their taste for diamond work, have issued a trade catalogue, containing some really handsome and novel designs in gem rings, bracelets and lockets. A forty years' experience as wholesale manufacturing jewellers and goldsmiths has enabled this firm to bring their work to the present standard of excellence, and their intimate acquaintance with ornamental art well qualifies them to provide for the ever-improving taste of the public.

There was recently received at the Milan Exposition a great curiosity in the shape of a clock made entirely of bread. The maker is a Peruvian, a native Indian, and he has devoted three years of his life to the construction of this curiosity. He was very poor, and, being without means to purchase the necessary metal, deprived himself regularly of a portion of his daily bread, which he devoted to the construction of this curiosity, eating the crust and saving the soft part for his work. He made use of a certain salt to solidify his material, and when the various pieces were dry they were perfectly hard and insoluble in water. The clock is of respectable size, and goes perfectly well. The case, which is also of hardened bread, displays great talent, both in design and execution, and taken altogether it would be difficult to find a greater curiosity.

Allgemeines Journal der Uhrmacherkunst.

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THE EFFECT OF LIGHT ON DIAMONDS.

DR. SCHNAUSS has recently re-directed attention to this subject, and has pointed out that coloured diamonds under the influence of extreme heat lose their colour, and, in most cases permanently, although in others the colours return after exposure to sunlight. According to Dr. Fright, under certain circumstances the coloured diamond is as sensitive to light as the photographers' chloride of silver is. A diamond merchant exposed a diamond to a very high temperature in order to destroy its brownish colour, but the stone became of a permanent rose-red. Coster treated another diamond in the same way, and that too turned rose-red; but the most remarkable part was that this colour was only permanent in the dark, and disappeared in four or five minutes if exposed to the sun's light, the stone acquiring a weak brown colour. This change also took place in a room where the light was by no means bright. Another diamond, of a dirty yellow colour, was ignited in a current of hydrogen in a porcelain tube, and allowed to cool there. The colour disappeared, but not the lustre. If this specimen were exposed to diffused light for six or seven minutes, its original yellow colour returned. Dr. Schnauss attributes such phenomena to phosphorescence.

Besides diamonds, ancient writers note that certain coloured precious stones grew pale in the light of the sun, and mention as one thus acted upon the beautiful green chrysoprase, the colour of which, however, they asserted—and, it is said, truly—could be restored by wrapping it in a cloth previously soaked in wine and excluding it in a cellar. There are many known cases in which the beauty of emeralds has been destroyed by leaving them exposed to strong sunlight. A writer mentions a dark green emerald which he had worn seven years as losing its colour and value from this cause.

THE MEDAL OF THE TURNERS' COMPANY.

THE Council of the British Horological Institute offer the Silver Medal of the Turners' Company, placed at their disposal by the Master and Court of the Worshipful Company of Turners, for competition under the following conditions:—

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The Council reserve the right of withholding the Medal in case no work of sufficient merit be sent in.

MAGNETIC PROPERTIES OF NICKEL.

M. WOLLET, a Russian physicist, we learn from *Nature*, sums up the results of his researches upon the magnetic properties of nickel as follows:—Pure nickel can become permanently magnetic to a considerable degree, thus differing notably from pure (soft) iron. The maximum quantity of magnetism which pure nickel can retain, however, is only about one-half or one-third of that which hard steel can retain. The magnetism of nickel is less permanent than in steel after the magnetising force has ceased to act; the gradual loss of magnetic force being greater with nickel than with steel, the temporary magnetism which pure nickel can retain is about double its permanent quantity, or about one-half of the temporary magnetism which hard steel and about one-fourth of that which soft iron can retain. These results verify, therefore, the general belief prevalent among physicists that in its magnetic properties nickel is notably inferior to both iron and steel.

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THE AFRICAN GOLDFIELDS.

By William Ford.

It is only in recent years that the old saw of "Afric's flowing rivers, bringing down the golden sands," has been applicable to the southern part of the continent. To the German explorer Herr Carl Manch is due this important discovery. He was a traveller that previous scientific training had fully qualified for the task.

When passing through Natal he pointed out spots likely to be productive of this ore. His prediction was speedily verified, although the present results have been insignificant. Journeying onwards he passed through the Transvaal, and indicated other localities as gold-bearing. His reports had their natural effect. Many persons began to look about them. Mr. Button established the fact that auriferous quartz was existant at Eersteling, near Marabastadt. Mr. MacLachlan, after several months of arduous prospecting, found payable alluvial gold some thirty miles to the eastward of Lydenburg, in the north-east position of the Transvaal. In fact gold was soon seen to be widely disseminated over this part of the country; for fifty square miles it is scarcely possible to take up a shovelful of the soil without finding a speck of gold in it. Even the capital of the Transvaal is founded in golden earth. A friend of mine was shown at Pretoria by Mr. Lys a small vial of the precious metal that had been washed by his young son from the earth of the water-course that supplies the down. The artist-traveller, the lamented Thomas Baines, pierced the country to the north-west, and established the fact of the existence of an extensive and productive auriferous district beyond the Tati. Livingstone had previously made known to the world the old workings on the Zambesi, but to Manch is due the crowning feat of the discovery of the now silent and solemn ruins that mark the supposed site of ancient Ophir, of Scriptural renown. The very names by which the long-sought ruins are now known to the natives, Zimbaoe, Zimbabye, and Mazimbaoe, have a metallic ring to those even only slightly acquainted with African languages.

My friend Baines thus describes those interesting relics of bygone industry. Here Manch found that the natives had been long accustomed to work for alluvial gold, and he himself after finding some expressed his hope of being able to work out enough to keep himself from want during the journey. He reported the goldfields as only half an hour north from Pikes Kraal; and the people are likely to engage in gold washing at some future time. The ruins are eleven miles east of the Kraal; they are extensive, and one collection covers a considerable portion of a gentle rise, while another, apparently a fort, stands on a bold granite hill. The walls are still thirty feet in height, and are built of granite hewn into small blocks about the size of our bricks, and put together without mortar. The most remarkable of these walls is situated on the very edge of a precipitous cliff, and is in perfect preservation to a height of thirty feet. The walls are about ten feet thick at the base and seven or eight at the top. Under a great mass of rock, Manch found a broken vessel, "shaped like a wooden Kafir basin," of talcose gneis, extremely soft, eighteen inches in diameter and three inches in depth, one and a half inches in thickness at the edges, and half an inch thickness at the bottom. The dense bush and gigantic nettle plants, the jealousy of the natives, and want of means, prevented further investigation. Whether, indeed, this locality was the "Ophir" of gold is of course still open to discussion. A solitary traveller, barely able to carry beads and calico enough to pay the expenses of himself and native servants, could not be expected to dig for relics and inscriptions; but I may mention that these are not the only collections of such ruins known to exist. My friend the Hon. G. C. Dawnay saw and sketched a mass of similar masonry about eighty miles north-north-west of Tati, and others are reported in the Transvaal several days, journey east of Uylstroom. Before Manch's visit, rumours had been for many years in circulation that the Boers of the Transvaal knew of the existence of gold in different parts of their territory. It was also stated that they were very reticent upon the subject, as they feared it would attract the Englishman into their country and lead to their being dispossesed of it. Late events prove that their impression was not without reason.

Following Manch's reports, Mr. Button and some companions started on an exploring and prospecting expedition, and after very little trouble they discovered auriferous reefs near Marabastadt, about 120 miles north-north-east of the capital, Pretoria. The lands were named Eersteling, which may be interpreted "firstfruits." Mr. Button immediately secured the farms upon which he had made his important discovery, and he had liberally accorded to him mineral and working rights by the Transvaal Government. He returned to Natal and proceeded to England, where he succeeded in establishing a company to raise the funds necessary to the carrying out of his undertaking. The outlay of this company has been large and liberal. Heavy quartz-crushing machinery has been imported and transported at great expense to the field of action. What returns have been made is best known to the shareholders. Up to twelve or eighteen months since the work done had been mainly preparatory. A large quantity of gold-bearing quartz had to be excavated from its bed and broken up preparatory to the fixing of the stamping machinery. From specimens which have from time to time been shown in Natal and elsewhere, highly satisfactory results may be expected. It is only the capitalist who can embark in such undertakings with the probability of reaping the fruit of his enterprise.

Two bands or belts of gold-bearing quartz, separated by a few miles of intervening country and extending from the Murchison mountains to the north of the Oliphant or Lipalulu River, traverse this part of the state. Although alluvial gold is found at Eersteling, it cannot at present be termed a payable alluvial field. Numbers of other quartz reefs are known to those who have traversed the Zomtpansberg, Waterberg, and Lydenburg districts, but no proper tests have been applied to ascertain whether they are gold-bearing.

The Tati or Victoria goldfields of Matabili Land were first pointed out by the veteran elephant hunter Mr. H. Hartley. There are several parties digging and crushing the quartz rock. The London and Limpopo Mining Company, under the direction of Captain Leveret, has established extensive works. The late Mr. Baines had also mining rights accorded to him by the ruling chief of Matabili Land, but the company that was formed in England to supply the necessary machinery were so dilatory in their proceedings that that distinguished explorer and discoverer sank under the disappointment and vexatious delay, and died in 1875 at Durban, in Natal. The chief drawback to these workings are their remoteness and the expense of conveying machinery and provisions, the entire distance from Port Natal being more than 1,250 miles. However, the steady application of those who have penetrated so far, and the gradual accession to the numbers of the workers, both reef and alluvial, would indicate that sufficient encouragement was presented to the pursuits. The most sanguine hopes are entertained that the gold-workings of South-Eastern Africa may yet prove a formidable rival to those of California and Australia, and have the ultimate effect of attracting a population of settlers to lands as productive and healthy as any in the world. It has been said that there are corn lands enough in the Transvaal and Free State which, if cultivated and ready means of transport provided for the produce, would supply the deficiency of the world. When the vast area over which gold is known to be spread is duly considered, it affords assurance that discoveries will be made in the proximate future that will not be without important consequences.

The goldfields of the Lydenburg district have proved the most attractive to the adventurous man of small means. Lydenburg, the chief town of the division, lies in the north-eastern part of South African Republic or Transvaal, and is distant about 180 miles from Pretoria, the capital, and 420 miles from the Port of Natal. The size of the trees growing in the town shows that its settlement is not of very recent origin. It can be reached from Natal by ox-waggon during the summer season in a month or five weeks. This point is almost always first made by those proceeding to the goldfields of the Blyde River, Pilgrim's Rest, and Macamac. Occasionally some of the diggers have journeyed to the fields by the way of Delagoa Bay, but as this port is in the hands of the Portuguese, and as the flat country to be traversed that intervenes between the bay and the workings is in the wet season exceedingly ripe with fever, few select this route, although the distance to be traversed is only 150 miles. It is therefore advisible to proceed by the longer but healthy land route by the way of Natal, Wesselstroom, Meddelburg, and Lydenburg. The workings lie between thirty and forty miles to the eastward of Lydenburg. For two-thirds of this distance the road is pretty good, but afterwards, as the country increases in beauty and the surrounding scenery becomes truly magnificent, the track to be traversed is exceedingly precipitous. The comparatively flat and high lands to the interior, often rising to an elevation of 6,000 or 7,000 feet above the level of the sea, here begin to fall off rapidly towards the Indian Ocean, and steep follows steep in quick succession, until the broken country of the lower regions is attained. Soon after reaching the limit of the plateau, which is marked by mural rocks of great elevation and beauty, time and tempest worn and grey with lichens and mosses of a thousand ages, about whose mist-enveloped heads the vapour-laden winds from the ocean beat and roar in their courses to the heated deserts of the interior, the site of the workings first breaks upon the view. Away to the right, where long water-races have been cut in the sides of the hills and mountains, appear the white canvas tents and iron-roofed dwellings of the collected diggers dotting the hills, valleys, and sides of a stream that after running for two or three miles empties itself into the Blyde or "Blythe" River, above which stands the town of Pilgrim's Rest. Along the banks of the creek and up the Blyde are the diggers' claims. Fifteen feet frontage by fifty feet back was the original size of the claim. When water could be let out so as to sluice and work more distant ground, other claims were granted; these were called terrace claims.

Macamac is a few miles higher up the Blyde, near a remarkable mountain termed Spitz Kop over 7,000 feet in height. The working is extremely laborious, the digger having to stand knee-deep in water attending to his sluicing gear; but he has the aid of Kafirs, who are soon trained to his purpose, and materially increase his returns. The climate is delicious and healthy, the surrounding country picturesque and fertile. Imported provisions are expensive, almost everything of this description having to be brought up from Natal. Bread and meat are, however, comparatively cheap. Some articles of light weight are procured from Delagoa Bay; here the duty being moderate and the distance short, unite to diminish the first cost of the retailer. A good road has been cut from Delagoa Bay to the Lebomba mountains, the worst part of the route, by the Portuguese, in order to facilitate commerce. The present white population at the fields does not exceed 300 persons, the late unsettled state of the country having deterred many from joining these persevering adventurers. No great work has been done in prospecting the surrounding country. The cost of provisions and the arduousness of the undertaking prevent the unsuccessful man from the enterprise; the fortunate digger who has made his pill disdains the labour which to him would bring no additional advantage. Hitherto the Government has given but small encouragement to prospectors; all that a prospector would obtain as a reward for a discovery, however important it may prove, would be two claims instead of one. This is not sufficient temptation for a man to camp out on the hills, carrying his own supplies, tools, cooking utensils, and blankets. When the Government can be brought to understand its own interest and offer a substantial reward as is done in Australia, there can be no doubt that other revelations of the great mineral wealth of this district will be speedily made. With regard to the success of the present workers, a great deal depends, as in every other enterprise, upon the industry and judgment of the individual. I have no hesitation in stating that several diggers have amassed their thousands, many more have made their hundreds, others have been discouraged by non-success and left in despair, while the old hands and their successors to the best ground keep steadily to their workings, and reap the reward of their perseverance. Nuggets have been found of singular purity and beauty, weighing from a few pennyweights up to one of thirteen pounds; but the greater portion of the gold is grainy in character, incrusted with a ferruginous film, and often intermixed with particles of quartz, from which it is readily separated by hammering on a stone or anvil; a minute portion of silver is blended with the gold. An extract from the journal of the late Mr. T. Baines, written some time back in the early days, but recently published, will give an idea of the prospects of these alluvial workings. On the 24th of February, the editor of the *Goldfields Journal* vouched for finds of eighty-five ounces, five ounces, and four ounces. Mr. West, an Australian digger of more than twenty-five years' experience, reported that about 300 men were at work, and all finding more or less gold. Five claims were yielding two ounces a day, while some were not making wages. Another digger, writing from the spot, says some find from three to four pennyweights per day, others as many ounces. Mr. Kumow, an old digger, working alone, got sixteen ounces from one and a half load of stuff. You often here of similar strokes of good luck, but some parties are making nothing. On the 24th of February, Dr. Scoble, of Natal, found on a terrace a nine-ounce nugget and three ounces of small gold, while a day or two before, young Steere, of Maritzburg, turned out a five-pound nugget at Pilgrim's Rest. In March, a nugget of pure gold weighing twenty ounces nine pennyweights was found by M. Da Costra in the claim of Dr. Thompson. It was found in the top stuff, and lay snugly underneath a large stone. In April, a nineteen-ounce nugget was found, and another of a pound weight, the result of a day's sluicing; while in a private letter it was reported that the diggers at Pilgrim's Rest creek were satisfied with the doings. One is mentioned that had averaged one and a half ounce for 100 days, but says that Steere denied having found the reported five-pound nugget. One digger had worked two months without success and then shifted ground, and found in a few days a two and a half pound nugget and lots of smaller ones. One person left the field for a trip to England with fifty pounds of gold, leaving his claim to be worked by a party till his return. He states also, in information he believes to be reliable, that there are diggers on the fields who have in their possession from 1,000 to 1,300 ounces of gold, all of their own finding. He himself had started digging with a mate; his first week was successful, but the second was occupied in nothing but removing boulders; at the date of his letter he was doing well and satisfied. He adds, a singular occurrence took place the other day. A piece of land thought nothing of by the old hands, who were working on the opposite side of the creek, was rushed by an adventurer, who found on the first day, nine ounces; second day, thirteen ounces; third day, eleven ounces; and has done well every day since. Claims are valued at from £40 to £300 each, according to the nature of the ground.

CORRESPONDENCE.

It must be distinctly understood that we do not necessarily identify ourselves with the opinions or views of any of our Correspondents. Our pages are alike open to all for free discussion of questions connected with the various trades which we represent, and all Correspondents will find every opportunity afforded them for expressing their opinions.

To the Editor of the Watchmaker, Jeweller, & Silversmith.

Sir,—Being a subscriber to your valuable journal from its commencement, and seeing on page 247 of May issue a quotation from the daily papers relative to "the want of a clock," as expressed so unceremoniously by a judge at the bar "hearing a case before the barristers in Nisi Prius, asserting that it was the most barbarous court he ever sat in, and was surprised Shropshire should be satisfied with such a state of things," as the curator of the Shrewsbury clock, I beg to state that in response to the barbarism so barbarously emanating from the bar, a new clock has been fixed up for the use of the barristers, by order.

Yours respectfully,
The Curator of the Shrewsbury Clock.

Wyle Cop, Shrewsbury, July, 1878.

BOOK NOTICE.

Treatise on Modern Horology, in Theory and Practice. Translated from the French of Claudius Saunier by Messrs. Julian Tripplin and Edward Rigg, M.A.

Part V., now ready, contains:—*Cylinder Escapement*, continued: Length of escapement arm; height of the incline; too high and too low inclines; the main incline; proportion of moderator to escapement arms; experimental verifications; size of the escape-wheel; the form of the teeth. Rules for constructing the Cylinder Escapement, deduced from theory and experience; straight and curved inclines; properties of straight and curved inclines; resistance of balance spring; the drops.

Part VI. treats of the height of the incline, tangential escaping, influence of the weight of the balance on the height of the incline, the opening of the cylinder and the form of its edges, the form of the lips, size of the axes, size of the escape-wheel.—*The construction of a standard cylinder escapement, and experimental data.*—Natural compensation. Means of practically determining the dimensions of a cylinder escapement. To ascertain the height of the impulse plane and the size of the balance. Half-timing. To ascertain the most advantageous relation between the balance and its spring.

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TRADE RECIPES, &c.

NICKEL PLATING.—M. Kayser, a recognised authority on nickel plating, in the *Chem. Centr.*, gives the following select conditions for nickel plating. The articles to be plated to be carefully cleaned, and put in a bath composed of one part of the double sulphate of nickel and ammonium to twenty parts of water, the nickel salt to be pure, and also the nickel anode, which should not be smaller than the article to be plated; the current employed to be strong. When the bath gets acid, it should be neutralised by the addition of dilute ammonia. In plating copper articles, the bath should contain ammonium chloride, one part to one hundred parts of nickel salt.

INDUCTION MACHINE FOR NICKEL PLATING.—By a simple modification of Siemen's armature, M. Gaiffe obtains sensibly-constant induction currents for electro plating. Instead of a cylindrical bobbin turning concentrically within cylindrical notches in the poles of the inductor, M. Gaiffe employs a bobbin of elliptical section turning in elliptical notches. The major axis of the ellipse of the notches is in plan parallel to the arms of the inductor. The major axis of the ellipse of the bobbin is a little shorter than the minor axis of the notches, so that the rotation may go on without friction. By trials a relation can be established between the diameters of the two ellipses such that the changing of polarity, instead of taking place during a brief interval at each half revolution, is produced gradually during the duration of the half revolution, and consequently gives rise to a sensibly-constant current. M. Gaiffe does not pretend that a machine of this kind is more economical than one with ring bobbins, but he holds that it has the advantage of being fitted to receive, whatever its dimensions, helices of wires of all thicknesses, a condition difficult to realise with annular bobbins; and consequently, with a given speed of rotation, it may be regulated so as to give the electro motive-force required for the work with the least internal resistance.

TO MAKE WATCH HANDS RED.—Mix to a paste over a lamp 1 oz. carmine, 1 oz. chloride of silver, and ½ oz. tinner's japan. Put some of the paste on the hands, and lay them face upwards on a sheet of copper, holding it over a spirit lamp until the desired colour appears on them.

POLISHING POWDER FOR GOLD ARTICLES.—A polishing powder, highly esteemed by the gold-workers of Germany, consists of sesquioxide of iron (iron rust) 70 per cent., and sal ammoniac 20 per cent. To prepare it, protochloride of iron, obtained by dissolving iron in hydrochloric acid, is treated with liquid ammonia until a precipitate is no longer formed. The precipitate is collected in a filter, and, without washing, is dried at such a temperature that the adhering sal ammoniac shall not be volatilised. The protoxide of iron precipitate at first becomes charged with sesquioxide.

BELGIAN BURNISHING POWDER.—A burnishing powder in use in Belgium is composed of ½ lb. fine chalk, 2 ozs. pipe clay, 2 ozs. white lead, ¾ oz. magnesia (carbonate), and the same quantity of jeweller's rouge.

WATCHMAKER'S BRUSHES are a constant accompaniment to the watch bench, nothing except plyers, screwdriver, and tweezers are in more constant use; and how few use them properly, or rather, how few keep them in proper use. A soft brush for rough work is quite useless, a hard one for fine work is ruinous, and a dirty brush of either kind is a nuisance. The methods adopted for cleaning them are nearly as various as the workmen that use them, and there are some who never make even the attempt. Some clean the brush with dry bread; some lay a piece of tissue or other paper across the wide open bench vice, the sharp corners formed by the jaws taking off on the paper a little of the dirt; others vigorously brush a piece of clean cork; and one man I knew used his knuckles for the same purpose. All these various modes are imperfect, and some of them very slovenly. The only good way to clean a brush is with soap and water—warm water being preferable if convenient. Wet two brushes, soap them, and then rub them together in plenty of water, and the job is done. The only objection to this way is the delay by drying; but this need not be, for six brushes assorted will give you three clean ones to use while the other three are drying; and the workman who cannot afford half a dozen had best seek some more lucrative occupation. More damage to the appearance of the movement is done by injudicious brushing than by any other means. The watch may not be injured in its quality as a timepiece, but it grows prematurely old in looks by such severe treatment.—*R. C.*

TO HARDEN COMPOSITION PIN-TONGUES.—Composition pin-tongues are always so soft for about one-third their length above the joint, as to give no satisfaction in use. It is occasioned by the wire becoming annealed in soldering on the joint. A very simple, easy way to harden them again is to fasten the joint in the pin vice, then hold firmly, *near the point*, with the plyers, and twist the pin around (by the vice) till you *feel* that it is sufficiently stiff. This will leave twist marks, gradually diminishing towards the point, which can be entirely burnished out, leaving a firm, stiff, well-appearing pin-tongue. The job is done quickly, and well repays the trouble.

WET-COLOURING BY THE GERMAN PROCESS.—Tie up your work in small bunches with fine silver or platinum wire; then, for 3 ozs. of work, take a blacklead pot, 6 or 7 inches high, and having previously placed your work in hot water, put into it of saltpetre 6 ozs., and of common salt 3 ozs.; stir them well with a wooden spoon, and when thoroughly dried fine and hot, put into it 5 fluid ozs. of muriatic acid. When boiling up, put in your bunch of work, having previously shaken the water from it, and keep it on the move for three minutes, care being taken to keep it well covered all this time. At the end of this time, take it out and plunge it into a vessel of clean hot water, finally into a second vessel of the same. Add then to your colour in the pot 6 fluid ozs. of hot water, and when it boils up again, after being thus diluted, put in your work for one minute longer, and again rinse it as before directed, when it will be found to be a beautiful colour. Too much clean hot water cannot be used for plunging the work in each time through the "colour." If the work is hollow work and bulky, not quite so much as 3 ozs. should be put, as it is not so effectually covered in the pot. In wet-colouring, it sometimes happens that the colour is rather dead, or it may happen that the "colour" burns, which causes the work to look brown: this is a precipitation which may be removed by scratching at the lathe with stale beer or ale with a fine brass wire brush, similar to the round hair brushes used for polishing. In colouring, a large stone jar should also be provided, into which should be emptied your "colour" when done with, for the pot should be washed out each time, so as to be ready when required again. Into this stone jar should also be emptied the water in which you rinse your work, as it all contains gold to a great extent. All things connected with the process should be kept clean and free from grease of any kind. No iron ought to be kept near this wet-colour in the pot, as it is most injurious.—*James E. Collins.*

HOROLOGICAL SECTION AT THE PARIS EXHIBITION.

THE following is a list of the gentlemen who have been entrusted with the honourable task of deciding on the respective merits of the exhibits in this class:—

England	Frodsham.
United States	Thomas W. Knox.
Switzerland	J. B. Grandjean and D. Perret.
France	Chopard, E. Tapy, Redier, and Cl. Saunier.

GOLDSMITH'S WORK OF THE ANCIENTS.

By the Author of "Antique Gems."

(*Continued from page* 270, *vol. III.*)

Of these the most important is the crown of King Recesvinthus (A.D. 653), a broad circle of fine gold, eight inches in diameter, set with thirty uncommonly large pearls, alternating with as many fine sapphires. This band is edged with a border above and below, filled with a running pattern of Greek crosses of red pastes *cloisonnées* in gold. From twenty-four little chains hang these letters of gold encrusted with pastes like the borders—

✠ RECESVINTHVS REX OFFERET.

From the letters again are suspended twenty-four *pendeloques* in gold and fine pearls, which support twenty-four pear-shaped sapphires, forming a fringe all round the circumference. Lowest of all comes a very magnificent Latin cross of truly elegant design, four inches long, set with eight enormous pearls and six equally splendid sapphires, and having three pendants from the arms and foot cut out of square *pastes*. The pearls are as big as ordinary cherries, the sapphires of the best colour, those in the middle row as large as pigeon's eggs, all *cabochons*, the centre one very protuberant. In the cross the gems are set *à jour*, the back of their collets being filled in with a rose ornament in filigree. The settings themselves are exquisite, the claws holding the stones being fleur-de-lys. This cross is the finest example in existence of ancient goldsmith's work.

The second crown, supposed to have been his queen's, is set with emeralds, sapphires, opals, large pearls (fifty-four in number), and has a fringe like the first, but of crystals and pastes. I strongly suspect from their shape that some of these "crystals" are in reality rough diamonds; that stone could hardly have been omitted from this assemblage of all that was most precious amongst the spoils of Rome. This crown has a pendent cross also set with sapphires, but which is quite plain in form and of small intrinsic value. The other crowns are much simpler, and embellished with but few and inferior stones; they were the coronets of contemporary counts and barons. Three of these coronets present a novelty in make; an open grating with gems set at each intersection of the bars, from each hangs a flat cross *pattée* jewelled, one of them bearing Sonnicas' votive inscription. The remaining three are much lighter, and are simply ornamented with arcades in *repoussé* work in the common Byzantine style. The small diameter of the last six shows that they were not designed to be worn, but merely for votive offerings. The two principal crowns, however, open with hinges, and the queen's has a row of rings along the edge, evidently serving for the adjustment of a lining.

All have gold chains proceeding from a centre or hook for suspension. In the king's crown this centre is artistically cut out of a large crystal into the pattern of Byzantine capital, about one inch deep, and somewhat wider across the top; around this again spread gold acanthus leaves supporting small pendants. The chains depending from it are stout, flat, almond-shaped pieces of pierced work.

It is curious to observe in some cases bits of mother-o'-pearl—which was regarded as precious, only second to the actual pearl, during the succeeding ages—set amongst valuable stones, and square pastes, now colourless, side by side with the richest: perhaps they were passed off upon the Gothic prince for real opals by the court jeweller of the day. It is very singular that neither the ruby nor the almandine should appear at all; the whole species (carbunculus) must have been purposely left out for some mystic reason, probably as being regarded of too *martial* a dye.

Most interesting, as it explains the destination of the treasure, is a large Greek cross bearing the inscription on both sides—

indni NOM INE offeret sonnica scie	marie ins ORBA ces

—which records its dedication by Sonnica in the Church of S. Maria in Sorbaceis, "in the grove of sorb-apples," supposed to be the present S. Maria de Abano placed at the foot of the hill on which stands the city of Toledo.

It may be remarked here that the Visigoths had enjoyed "the first pick" of the plunder of the dismembered empire. The nuptial gift which, according to the custom of his nation, was offered to Placidia by Adolphus (Alaric's brother and successor) consisted of the rare and magnificent spoils of her country, fruits of the recent sack of Rome. "Fifty beautiful youths in silken robes carried a *large* basin in each hand, and one of these basins was filled with pieces of gold, the other with precious, nay, rather with priceless stones." So says Olympiodorus, her contemporary, who from his mode of expression seems to have assisted at the ceremony.

CROWN OF CHARLEMAGNE.

Charlemagne was crowned Emperor of the West by Pope Leo, on Christmas Day, A.D. 800, in the Church of St. Peter's, Rome. His crown may, therefore, have been made in that city for the occasion; certainly its ornamentation has more of the Byzantine than the Frankish style. It is octagonal, formed by eight plaques of gold, with round tops, which thus make a scalloped border to its upper part. Each alternate plaque bears the figure of a saint in enamel. The first plaque is set with large stones *en cabochon*, and others cut square after the fashion of table diamonds. Above all rises a Greek cross also set with large stones; gems of less importance are equally interspersed upon the other plaques. From the cross springs an arch like a flying buttress, which gives stability to the entire fabric. Frederic Barbarossa, in the year 1166, canonised Charlemagne, and took advantage of the occasion, even if he did not create it expressly, to despoil his sepulchre of the crown, besides the enormous mass of treasure, infinitely magnified by tradition, there deposited—the golden throne, the two shields of gold, etc. Since that time the relic was used at the coronation of the succeeding German emperors, and the Elector Palatine had the custody of it *ex officio*. The Austrian Francis, as the last in the imperial series, had possession of the crown, and took good care to retain it; it now rests in the Imperial Library, Vienna, a mere monument of antiquity.

CROWN OF HUNGARY.

This memorial of the first establishment of Hungarian nationality has ever been regarded with superstitious veneration by every true Magyar, and authenticated every coronation of the kings of that country until the shameful overthrow of its liberties and constitution in our own times, when it disappeared, and its hiding-place remains known only to a faithful few. It is, in truth, a most venerable relic of the regular Byzantine art, and is formed by a broad, flat band of fine gold, whence springs an arch supporting a cross. It was sent in the year 1072 by the Emperor Michael Ducas to Geisa, first Duke of Hungary, or, as he is strangely, though with strict historical accuracy, styled in the enamel portrait of him upon a plaque rising above the top of the circle, "Geabitras, King of the Turks" (they were a colony from the Turks originally seated beyond the Don). Next to this comes the portrait of Constantine Porphyrogenitus, then one of Ducas himself; the fourth and largest enamel represents the Saviour, enthroned exactly as He is figured upon the legends of that period. These four portraits are set at the springing of the arches which close the top of the crown; in the front of the band itself are placed four smaller enamels of the angels Michael and Gabriel, St. George and St. Demetrius.

(*To be continued.*)

OUR PARIS LETTER.

(*From our own Correspondent at the Exhibition.*)

WHAT I stated in my last about the inadequate representation of English watches at the Exhibition may also be said of English jewellery. The arrangement of the exhibits is also defective; they are so scattered about as to appear even less important than they really are. Our leading firms, with but few exceptions, are entirely unrepresented, and were it not for the high-class productions of Messrs. Brogden, of Covent Garden, and Watherston and Son, of Pall Mall, continentals might not unreasonably conclude that the manufacture of artistic jewellery had ceased to be an English industry. This is all the more to be regretted as there has been a steady progress of late years among our best craftsmen, both as regards design and execution. If our art-jewellers think that they can rest on honours already won, they are mistaken. Perhaps some of them, considering the dulness of trade, have kept aloof from a motive of economy, which to my idea is a false economy; and if there is one thing which they cannot afford, it is the keeping out of this universal competition. French jewellers hug the idea that we have nothing to show. I have ciceroned many of them to our section, and with no little pride pointed out the exhibits of the above-mentioned firms. They also admire them, bestow well-merited praise, but then they naturally exclaim: "Is that all! Any country can boast of at least two first-class jewellers, and in France we count them by the hundred!"

Sir John Bennett shows some jewellery with his watches and clocks, and Mr. John Neal with his cutlery and table requisites. Creditable as some of the articles exhibited by these two firms are, they will, however, not stand comparison with Brogden's imitations of antique models. A very elegant collection of jewellery is displayed by Mr. Wm. Gibson, of Belfast, and I noticed some work of superior taste and workmanship. Messrs. Jaques, of Dublin, and McCreery, of Belfast, are exhibitors of bog-oak jewellery, and enjoy a good deal of attention from foreign visitors, which is well bestowed, some of their specimens being perfect gems of carving. Scotch jewellery is worthily represented by such well-known firms as J. Aitchison, Marshall, and Co., and Mackay, Cunningham, and Co., of Edinburgh, Messrs. J. M. Crouch and W. A. Crouch, of London. It is hardly necessary to say that the far-famed manufactures of Aitchison are as much admired in Paris as they were at Vienna and Philadelphia. The collection of Messrs. Marshall and Co. also contains some very elegant novelties. By imitating the colour of antique gold and silver ornaments, and an ingenious combination of black and white enamels, they have contrived to produce some very effective work. Another source of attraction which their case affords, are a number of bracelets formed of badges of Scottish kings and chieftans; also a variety of other articles of personal adornment of Celtic and Gothic designs. Altogether the display of this firm is a very attractive one, and occupies a prominent position in the jewellery section. Messrs. Dixie, Jeffries, Chapman, Son, and Co., Jenner and Knewstub, and Thornhill, all of London, offer a handsome and comprehensive show of jewel-cases and other jewellers' requisites.

The Indian court, with its crown diamonds, and the Prince of Wales' collection, is, of course, a great centre of attraction. To give a detailed account of the immense treasure collected here, it would require more space than you can grant to my letter; but I shall make it the subject of a special article for a subsequent issue. I may add that Signor Castellani also exhibits his valuable collection of Indian jewellery in this court. You will probably have read in the "dailies" that our Australian colonies give a very good account of themselves at the Paris Exhibition. Messrs. Henry Steiner and Joachim Wendt, both of Adelaide, show some excellent jewellery, and prove that our fellow-craftsmen at the antipodes are by no means deficient in ornamental art. Design and execution are both thoroughly Australian, and of an originality which recommends them at once to every one. Instead of imitating worn-out models, they have borrowed their types from the fauna and flora of their own beautiful country. Their gold-mounted trigonium and operculus shells look highly effective in bracelets, lockets, and solitaires, and quondongs formed into earrings and necklets are very elegant. Their Royal Highnesses the Prince and Princess of Wales took a great interest in these exhibits. Besides novelty and beauty, this kind of jewellery has the advantage of cheapness, and there is no reason why it should not become fashionable as well.

France again takes the lead in the jewellery line, their display being exceptionally fine. French jewellers have evidently done their best to demonstrate that a luxurious court is by no means essential for the fostering of their cultured taste and superior skill. In fact, it appears to me that Republican France has used all the resources at command to outrival the Exhibition under imperial influence and patronage; and that they have well succeeded, every one who has had the experience of both will readily admit. The array of precious stones in this section is something remarkable, and the eminent taste evinced in the setting is worthy of the costly materials employed. Such magnificent *parures* as Messrs. Boucheron, Marret frères and Jarry, Massin, and others offer to the public gaze, are not to be seen anywhere else. The first-named firm shows a matchless *parure* of diamonds and sapphires; the latter of prodigious size, and a deep sea colour. The diamonds are of the first water, and the sums reported to have been paid for some of these gems are fabulous. Messrs. Massin show some lace of brilliants for dress trimmings, which is sold at the rate of £700 a metre. The lace is of silver, perfectly elastic, and the brilliants are set in the meshes of it.

America does not make much of a display in jewellery, although Messrs. Tiffany and Co.'s collection includes work of a high order. In this section I may also mention Messrs. Barrows and Co. for gold chains, and Fairchild and Co. for gold pens, pencil-cases, and penholders. Mr. Hartman exhibits silver filigree, which is distinguishable for its strength and elegance of design.

The jewellery department in the Italian section is well worthy of a visit, and, as may be supposed, the models of such eminent artists as the Messrs. Castellani have had a beneficial influence on Italian jewellery in general. Pre-eminent among these exhibits ranks the collection of the firm just mentioned; it will, however, not be necessary for me to enter into particulars, as the article on "Antique Jewellery and its Revival," which appeared in the columns of your journal some time ago, has made your readers quite familiar with the works of these masters.

Next in importance stands the case containing specimens of antique jewellery, the productions of pupils of the "Jewellers' School" of Naples, which owes its foundation (in 1868) to Signor Alessandro Castellani, and is under the able direction of Signor Giaciuto Melitto. The predominating feature of Italian jewellery is filigree work, and its characteristics are neatness and lightness. Some of their flowers, butterflies, etc., are really handsome, and are evidences of a remarkable skill of execution. I also noticed some applications of filigree work to other ornamental objects, such as combs and picture-frames, and the effects thus produced are very pleasing. Special mention deserves a case of Sicilian amber jewellery of choice designs and tints. Messrs. Francati and Santamaria, who are also exhibitors in the British section, show some beautiful specimens of cameo-cutting and coral-work. Sweden seems to have made considerable progress in this branch of industry, and the silver filigree of Messrs. P. A. Lie, of Christiania, and Theodor Olsen, of Bergen, is of exquisite design and workmanship; but it has a yellowish tint, which considerably detracts from its beauty.

Russian jewellers make also a very respectable show, and many of their designs are exceedingly graceful.

Whilst English jewellery makes but a poor figure at the Exhibition, English metal-work, on the contrary, is a great success. It is all the more gratifying to say so because we have to compete here with formidable rivals. Such houses as Barbedienne, Christophle, Boquet, Martinet, Schlossmacher, etc., have for a long time occupied the front ranks of art manufacturers in metal, and their contributions to the Exhibition fully justify such a reputation. The name of Elkington has figured very prominently at every Exhibition, and some of the works of this firm have become classic. Their establishment enjoys the services of such first-rate artists as Morel-Ladeuil, Willms and Henry, and it is but natural that such talent would render material assistance in improving the taste and skill of the entire staff; it is therefore not to be wondered at that their Paris display should surpass all their previous ones.

Their court, which even a Cellini would behold with admiration, contains such a number and variety of specimens in *cloisonné, champleve* enamels, damascening, *repoussé* work of silver, steel, copper, and electro plate that it is impossible to do justice to it in such a limited space as I can command, and I must necessarily confine myself to a few of the leading objects. The *chef-d'œuvre* of this brilliant array is the Bunyan Shield, a minute description of which is to be found in the June number of this journal. Another work by the same artist is the Helican Vase, representing music and poetry, in *repoussé* silver and steel, richly damascened with gold and silver.

As next in importance I may mention the Peacock Vase, designed by Mr. Willms. It is oval in form, and stands about two feet high, its greatest breadth being about one foot. It is enclosed in a framework which is of itself a work of art. This frame is ornamented with steel panels, damascened with gold, and the border rests upon a pyramidal base, also decorated with steel panels, inlaid with gold and divided by bars of oxydised silver. Four ornamental feet support the base. The neck of this vase, surmounted by a domed cover, is a beautiful specimen of damascened work in gold and steel. The body of the vase is a gracefully-curved oval of steel, of a rich dark colour, and on the front are two peacocks worked in high relief by the damascening process. One of the birds has its plumage fully spread, while the other has it closed, the long tail sweeping downwards in a bold curve. On the reverse side is a representation of the lyre bird, executed in the same materials, and by the same process. In each case there are subordinate decorations of flowers, and other appropriate ornaments. Other examples of damascened work are a small ewer, about twelve inches high, with storks on one side and an eagle on the other; a little oval *bonbonnière*, decorated with buds and sprays of foliage. Another is a casket about a foot in length, six inches high, and the same in breadth. The base, which is finely chased, is of oxydised silver, oblong in form, with semi-circular projecting ends. On the body of the casket are panels of dark-coloured steel, bearing on one side a peacock, and on the other a pair of Java pheasants. On the top, which is slightly domed, are steel panels, with paroquets and humming-birds and floral ornaments, and this is surmounted by a little figure of the fairy Puck. At each end of the casket are groups of Cupids, in oxydised silver, holding gracefully designed drapery. The birds and other ornaments on the steel panels are all worked out in damascening of gold and silver. The entire casket is full of colour, owing to the different materials used. Another casket—called from its ornamentation the Stag Casket—is a notable work. It is composed of oxydised silver, with panels of boldly modelled figures of stags, arranged in natural groups, in free action; and on the cover are groups of storks and swans, also modelled in high relief. The cover is enriched by a band, studded with bosses of steel, inlaid with gold, and on the base are narrow panels of steel, with gold inlaying. A Milton Inkstand, in oxydised silver, forms another remarkable feature of the collection. It is nearly twenty inches in length, is pyramidal in shape, and has upon the summit a finely modelled group of Milton and his daughter—he seated, she standing and writing from the blind poet's dictation. The ink-dishes are ingeniously arranged at the ends, and are supported by groups of children. The whole work is enriched with chasing and with ornaments in high relief. Messrs. Elkington and Co. also exhibit some magnificent specimens of real *cloisonné* enamel and a fine collection of *repoussé* shields and damascened plates. One of their shields has been purchased for the Pesth Museum. Their re-productions of antique gold and silver plate after models in the South Kensington Museum also command a large share of attention. Amongst their exhibits of electro-plate two salvers and a tray deserve particular notice. The borders are saw-pierced, and the pattern adopted from the engraved work is foliated. The ground is of frosted silver, and the delicate autumnal tint of the leaves has been most successfully imparted.

Messrs. Watherston and Son also contribute some first-class silver work, and Messrs. Mackay, Cunningham and Co. show specimens of *repoussé* work in oxydised silver which would do credit even to the more renowned Birmingham establishment. A dessert service in oxydised silver, designed by Sir Noel Paton, and representing the principal scenes in Skakespeare's "Tempest," deserves special mention. Among the most notable of their exhibits are a miniature Walter Scott's monument in silver; the casket presented to Her Royal Highness the Princess of Wales in 1863 as a marriage gift from the ladies of Edinburgh; a handsome silver clock of Runic design, the figures representing the leading characters in the "Lay of the Last Minstrel"; and another in ormolu, representing the tower of St. Giles' Cathedral in Edinburgh.

While speaking of the silver-work in the Britannic section, I must not forget to allude to a remarkable piece of workmanship in the shape of a miniature engine. Both engine and boiler are made of sterling silver, and the former, with its two cylinders, comes *within* the space of a threepenny piece, and weighs exactly four pennyweights. The boiler is fitted with high and low water taps, spring safety-valve, and steam tap, all in working order. This ingenious mechanical contrivance is greatly admired, and reflects no little credit on its maker, Mr. Alfred Wilkinson, a watchmaker and jeweller of Bradford. It is said to be the smallest engine yet made with two cylinders, a claim which, as far as I know, remains undisputed. Messrs. Hodd and Son, Shaw and Fisher, and Ridge, Woodcock and Co. are representatives of the electro-plate trade, and display a tasteful and varied assortment of table-ware.

The Australian firms already mentioned as exhibitors of jewellery also contribute a share of silversmiths' work. Mr. Steiner shows a pair of claret jugs in which the mouthpiece takes the shape of the head of an emu; and Mr. Wendt some emu eggs very tastefully set with silver leaves and an epergne of superior design. In the centre are an eucalypetus tree and tree fern; a stockman on horseback with his native dog is pursuing a kangaroo, clearing trunks in true Australian bush fashion whilst a blackfellow looks calmly on. On the plinth are the South Australianin arms enamel, and reliefs indicative of mining, agricultural and pastoral pursuits.

American art metal-work has made rapid progress in a very few years, and Messrs. Tiffany and Co., of New York, are its worthy representatives at the Exhibition. Their display is really superb, and evidences a commendable spirit of enterprise on the part of the firm and a perfect knowledge of the craft by their workmen. At the very entrance of their court stands that magnificent piece of *repoussé* work, the Bryant Testimonial Vase, an illustrated description of which is to be found in your issue of March, 1877, and I shall therefore pass it without further comment. Their leading exhibit is, however, the Mackay Service, valued at £25,000. As may be expected from the cost of this service, it is most elaborately decorated; in fact, it is literally covered with exquisite *repoussè* work. The Japanese work shown by this firm is full of interest, and their laminations of a number of different metals fully surpass those of the modern Japanese. These American artificers have also succeeded in acquiring the Japanese art of colouring bosses upon hammered silver, thus giving the projections the appearance of agate and red jasper. Messrs. Tiffany and Co. have been no less successful in their attempts to imitate antique jewellery, and the copies are so faithful that even the most experienced workmen of Signor Castellani were unable to distinguish between original and copy. Their Royal Highnesses did not fail to visit this emporium of art, and showed their high appreciation by making several valuable purchases.

Mr. B. T. Oakley, an American merchant resident in Paris, exhibits three works of art in gold, which were made expressly for the Paris Exhibition, by the order of a lady in San Francisco, and after her own designs, and executed by a jeweller of San Francisco. The first is a massive and elegant *porte-monnaie* and card-case combined, made of solid gold and quartz rock, beautifully designed in mosaic interspersed with gold. The quartz rock comes from the mines of the States of California, Nevada, Arizona, and Washington Territory. The second is a lady's powder-box and puff, a very exquisite work of taste. This powder box is composed of quartz rock, from all the leading mines of California, Idaho, and Oregon, its shape being round, and made to resemble a Greek dome, the top or cover being supported by eight columns of solid gold quartz rock, beautifully polished, each capped with pure gold. The cover forming the roof of the dome is exquisitely inlaid with quartz rock of variegated colours, filled with the precious metals, and is bound on edge with a solid rim of gold, the inside being lined with gold. The whole is surmounted with the emblem of California, viz., the grizzly bear, who is represented as crossing the Great Overland Railway. The powder-puff is made of the same material, and is very elegant. Two pounds of solid gold, and the same quantity of gold quartz, were required to make the above.

The third is a jewel casket, representing the substantial mines of the Pacific coast. On the cover is a pictorial and historical representation of a buffalo hunt on the plains, with big trees, and a railroad track, with two bulls dashing across it to evade the hunters, who are in close pursuit. The casket contains nearly nineteen pounds of solid gold and auriferous quartz, and with the other pieces is valued at about £6,000. The case is made of different species of wood grown on the Pacific coast.

As already stated, French metal-work, especially for decorative objects, is very extensively and handsomely represented; and their bronze statuary remains unmatched. Italy shows but little in silver-work for domestic purposes, and what there is of it is unimportant. The Spanish section can boast of some antique vases of choice designs. Austria displays some very fair work, principally in gold and silver frosted articles. By a judicious combination of dead and bright gold, Austrian gold-workers have managed to produce some very effective wares. Sweden and Russia are both contributors in this line. The silver-work of the former lacks, however, the dark colour which secures such a rich appearance. Many of the Russian exhibits are elegant and effective, and show that the Muscovite silversmiths are well acquainted with the laws of proportion; but they have evidently not yet mastered the delicate finish which characterises the productions of their more eminent English, American and French fellow-craftsmen.

The antiquarian, Doctor Bigley, seeing an old, curious-looking clock, asked its nationality. "English," said the cockney proprietor, "and made by Tummas Fudgit; I've often seen clocks of his make." The Doctor was puzzled, but on close examination saw, in the corroded steel, the oft-repeated warning, *Tempus Fugit!*

SAFES AT THE PARIS EXHIBITION.

THE "lock-picking" fraternity has made such rapid progress of late years that what were once considered perfectly safe receptacles for valuables, afford in these days of scientific burglars no more protection than the drawers of a writing desk.

It is, however, gratifying to know that we have safe makers in this country who have outrun these "jemmy and jenny" gentlemen in the race for supremacy, and who have applied improvements and new devices to their manufactures which render the operations of even the most expert of these illegitimate artificers powerless. Anyone depositing his stock and valuables in a "Chatwood's Invincible" may sleep without being haunted by visions of "Scotty" or "Carroty Fred." Among the exhibits in the English Section which enjoy the special attention of visitors are Chatwood's safes and locks. Ever since the famous "Safe Contest" at the Paris Exhibition of 1867, when Mr. Samuel Chatwood, with his "Invincible," won the challenge stakes for £600 a-side, his name has stood foremost in the ranks of safe manufacturers. The pen of one of the most brilliant writers of the day, Mr. George Augustus Sala,* an eye witness to this duel between iron and steel, has fully demonstrated the impregnability of his safes. But it is not to be expected that a man of Mr. Chatwood's indomitable energy could rest on his hard earned laurels; on the contrary, his inventive faculty is ever at work in devising fresh means for making "safe" "doubly safe," and in anticipating modes of attack which are as yet unknown to burglars. Chatwood's display is also the largest in this class, comprising as it does, almost every kind of safe, from the small jewel safe to the massive bank safe. It is generally supposed that the manufactures of this firm are very high-priced, and we must confess ourselves surprised to find at their stand a moderato sized safe, with "Chatwood's Patent Frame and Solid Flange Lock Case," for the very moderate price of £15. What attracts, however, the special attention of the visitors is a steel model, one quarter of the full size, of a bank strong-room, designed for one of our largest Metropolitan banks. This strong-room literally bristles with new inventions. It is self-contained, requiring no brickwork or masonry, being in fact two steel rooms, one within the other, with the space between the two filled with a fire-proof composition. The banking-room is over the strong-room, and the latter is so arranged that on a horizontal door in the floor of the bank being unlocked, and a valve in a small safe, also in the banking-room, being opened, a safe rises out of the middle of the strong-room into the banking-room. This safe is large enough to hold the cash and books for the day's use. The locking arrangements are such as to preclude the possibility of injury, even the keys of the strong-room door below, and of the horizontal door on the top of the "elevator safe" are effectually locked out by the sentinel bolts in the small check-safe. The doors are of Chatwood's reputed "intersected steel," with his "Solid Flange Lock Case" and "T Frame." The bolts are his "Patent Claw Bolts," on all sides secured by his patent composite lock and his patent multiple point invincible lock. This room is lighted and ventilated on Chatwood's Patent System, and the walls of the rooms and its floor are protected by his hydro-pneumatic piping, which will give 36 hours' notice of any burglarious attempt. This model is undoubtedly the *chef d'œuvre* of the art and mystery of safe and lock-making, and no person interested should fail to inspect it.

Some excavations are at this moment being carried on under the Palace at Madrid, where twenty-six watches, possessing considerable artistic value, of an antique character, have been discovered.

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* "Battle of the Safes."

THE GOLD AND SILVER HALL-MARKING BILL.

THE Select Committee of the House of Commons appointed to inquire into the Gold and Silver Hall-marking Bill, now before Parliament, resumed its sitting on Monday, Sir Henry M. Jackson presiding, and two of the witnesses called were Mr. Walker, watchcase maker, and Mr. Read, of the firm of Read and Son, both of Coventry.

Mr. Walker said he did considerable business, and he had come to represent to the Committee the views of the watchcase industry of Coventry. Their ground of complaint was that foreigners were allowed to have their cases marked in England, and they in consequence had so many less cases to make. The system of hall-marking foreign watchcases assisted in defrauding the public.

The Chairman: It may be suggested that it would be to your interest to make watchcases for any comer, foreigner or Englishman.—The Elgin Company have applied to me to make watchcases for them, but I refused. The agent said they had embarked very largely in the manufacture of watches, but they could not dispose of them because they had not the English mark. The Bill, as drawn, prohibits the marking of foreign watch cases in England at all.—Do you think it necessary to go so far as that? Another suggestion has been made, namely, that the goods should be allowed to be marked as a guarantee of their quality, but so distinctively marked that no one could possibly mistake them for English goods?—My opinion is that they should not be admitted under any circumstances. If they are marked, the mark should be of a more distinctive character than our own.—Now, Mr. Walker, it has been suggested that this is mere protection; that your object is merely to prevent foreign competition?—We don't object to foreign watches being sold in our market as foreign watches, but they are often sold as English watches, and it is from that we suffer.—We have had evidence here to the effect that in regard to watch cases it might be desirable to have no hall-marking at all?—It would amount to a voluntary swindle.—You are prepared to submit to hall-marking rather than lose the benefit resulting from it?—Yes. We go in for compulsory hall-marking, confining it to British made cases only.—I have heard it said that the Bill does not go far enough, and that it would be better to keep English movements out of foreign watch cases.—I am willing to submit to that dictum, but the subject might be better dealt with by other gentlemen present.—Tell us what is the size of the trade in Coventry?—I think that the trade of Coventry more than doubles that of London and Liverpool put together.—That is in complete watches?—I cannot inform the committee how many watches are made in Coventry annually, but I approximate that there are about 10,000 hands employed in the trade.

By other hon. members: One of the clauses of the Bill suggests that in case of suspicion a dealer should be required to sign a declaration that the watches he presents for marking are not foreign-made watches.—I think it would be practicable to obtain such a declaration. Hall-marking of foreign goods undoubtedly gives to them a sort of British character. What we complain of would not be fairly met if vendors of watches were obliged to distinguish between foreign and English watches. The proper way is to shut out foreign watches altogether. It is quite clear that our halls were not established for foreign business. The word "dealer" has of late years been inserted in the Act. I would suggest that only the word "manufacturer" should be employed.

Sir J. Leslie: Do you think it reasonable to prevent a man buying a watchcase because it is made in another country?—No, not if he buys it for a foreign-made watch.

Mr. Muntz: You say you have refused to make cases for a foreign company. You know some gentlemen would do it?—Some have made them.—Perhaps you know there are men who would be prepared to make a declaration that foreign watches were English?—I don't think it.—You don't think there are men so wicked. (Laughter.)

Mr. Bates: Suppose you had a punch an eighth of an inch, and you not only have the English mark, but a foreign mark in the centre. You could not get the foreign mark out. Would not that answer your purpose?—They could not get it out.—Then would it not answer your purpose?—No, certainly not. There should be a distinctive mark to prevent them coming here at all. (Laughter.) I have no objection to foreign watches being marked as foreign watches.—Then you are a free trader?—I am a free trader, and have been all my life.—In all things but in watchcases? (Laughter.)—I have been in watchcases.

By Mr. Whitwell: My cases are chiefly marked in London, but I get some marked in Chester. The reputation of the Birmingham plate got so bad that I was obliged to send my goods to London.

Mr. Bates: If you had a hall in Coventry you would send your goods to be marked there?—Yes; if a universal mark for England were adopted.

Mr. Muntz: Is it not a fact that as many watches are marked at Birmingham as at London?—I have no knowledge on the subject.—You say Birmingham has got a bad name?—I can't tell you why, but thirty years ago, no matter how well I made my cases, it was no use forcing them on Coventry manufacturers if they were marked at Birmingham. They were really considered Brummagem ware. (Laughter).

Mr. Rogers, watchcase maker, Liverpool, gave similar evidence to Mr. Walker.

Mr. Read said the firm to which he belonged were manufacturers of complete watches, and he was prepared to speak on behalf of the watch manufacturers of Coventry.

The Chairman: What is the opinion of the trade in Coventry upon the law which permits foreign-made watches to be registered and marked with the English hall-mark?—They consider it misleads the public. My objections are pretty much the same as those of the witnesses who have preceded me to-day. It must always be an educated eye to tell the difference between a foreign and English made watch. I think that voluntary hall-marking would be an entire mistake. It would encourage fraud. I would not allow any watch which was made up of an English hall-marked case and foreign movements to be sold unless it had a distinctive mark. That could be done by imposing a penalty on the sale. If we could not get absolute prohibition, we would be satisfied with a distinctive mark for foreign watches, providing it was so entirely different as not to be capable of being misunderstood. I agree with Mr. Walker as to the advisability of a universal mark for England.

The witness had not concluded when the committee adjourned. —*Coventry Herald, 26th ult.*

BRITISH HOROLOGICAL INSTITUTE.

THE Annual General Meeting of the members for the election of officers and the transaction of ordinary business, was held on Tuesday, July 16th. Mr. John Jones, F.R.G.S., V.P., in the chair. The report presented by the council indicates a steady progress. There was some discussion on the casemakers' Bill now before Parliament, considerable difference of opinion prevailing among the various speakers.

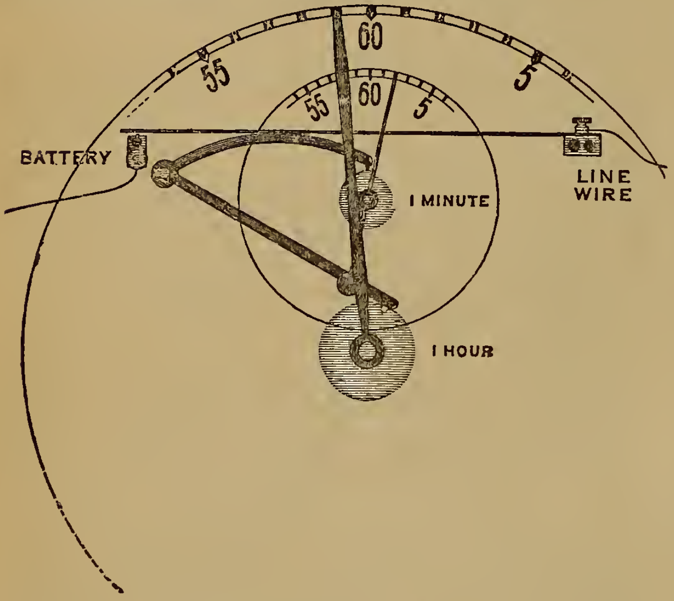
The following is a list of the officers for the ensuing year:—President: Sir Edmund Beckett, Bart., LL.D., Q.C., F.R.A.S. Vice-Presidents: John Jones, F.R.G.S., Samuel Jackson, David Glasgow. Treasurer: Thomas Mercer.

CORRECTION OF CLOCKS BY ELECTRICITY.

A Paper read before the Royal Scottish Society of Arts by F. James Ritchie, Edinburgh.

(*Continued from page* 8.)

THIS disk is also useful in admitting of any testing of the any line wire by applying a constant current without affecting of the clocks in circuit, which test may continue for about 50 minutes in each hour. Thus any fault or bad connection may be discovered and removed. As a constant check on the currents sent out, we introduce an indicator into each line, consisting of a magnet similar in size to those used in the clocks, but of rather less working power. The armature is employed to move forward a hand one division upon a dial for every current which passes out, consequently any fault or want of continuity in the wire or battery is early noticed.



I shall now, in conclusion, indicate some of the advantages of this system over the previous methods of correction.

1st, Extreme simplicity and lightness of the mechanical parts, and any one conversant with electricity will at once understand how much depends on that.

2nd, The battery power required to work it is very small. This is obtained—

(*a.*) From the amount of motion in the stop pin being so small, and the distance to be traversed by the armature being only about one-third of that (such is the proportion of the levers), that the magnetic action is very powerful.

(*b.*) No mechanical work is demanded of the current in setting the hands of the clock.

(*c.*) No friction requires to be overcome except that of the axis or centre on which the lever works.

(*d.*) The preponderance of the levers over the armature is just sufficient to ensure their falling out of action, consequently no power is wasted in doing mere mechanical work or lifting useless weight.

The friction which (although it would prove very small) would be caused by the pressure of the scape wheel upon the stop pin is got rid of entirely by taking advantage of the inclined surface or impulse face of the pallet to wind back the wheel by the vibration of the pendulum, and allow the lever to fall freely out of action.

3rd, The certainty of action is very great, as the forward motion of the clock is arrested at the last wheel, or the point of greatest leverage in the train, and all uncertainties of elasticity are removed.

4th, The hands may be so securely fixed as that no exposure can affect them without wholly stopping the clock. By no other method yet suggested could correction be applied to a large steeple clock. Any interference with the hands of such would result in destruction of the apparatus or breaking the hands.

5th, The range of action is also very great. Should the clock be accidentally set slow of correct time, it will by its normal gaining rate be accelerated till the hands indicate correct time, and only then will any action be performed by the corrector. Should the clock be set fast, even to the extent of five minutes (for the notch is cut to cover that extent of error), then the corrector would, by arresting the wheel-work of the whole fifteen seconds in each hour, gradually eliminate the error, and have the clock automatically set to coincident time with the normal clock, and then resume its correcting action.

6th, It is applicable to clocks of all qualities and sizes, from the commonest German or American kitchen clock to the largest clock ever constructed, or which could be made or even conceived.

7th, The smallest possible expense in furnishing and fitting of apparatus and maintenance of battery power.

By this system any number of clocks may be connected up, and kept to coincident time. Any derangement in one clock, so long as the wire connection is maintained, does not interfere with the action on other clocks in circuit.

The electro-magnet which we use for ordinary clocks has only a resistance of 1 ohms, and for steeple clocks not exceeding 6 ohms, as against a sample of another patent system which has resistance of 18 ohms for use in small clocks, so that the introduction of several clocks is little felt in the circuit, while additional lines of clocks and batteries can be put in operation by using a relay to repeat the signal.

The expense is merely nominal where several clocks are operated on by the same battery. In proposing our system and arranging the charges, we calculated on thirty clocks as the starting-point within a certain distance—offering it at first in Leith, as the principal merchants' offices were confined to a small circle. The cost naturally divides itself into—1st, The furnishing and applying the apparatus to each clock, which becomes the property of the owners; and 2nd, Supplying the use of automatic clock relay and indicator, battery power, wire connections, and the supervision of the whole. For the first part a certain sum is charged, depending upon the description of the clock, while the other items are embodied in one annual charge.

If during the past fourteen months we have had some trouble with our lines, and experienced some irregularities in action, these have been mainly due to the disadvantages to which we have referred in the method first adopted, and are such as we trust cannot occur in the later and more improved arrangement.

On first introducing the system to the public we proposed a visible and audible signal in addition to the automatic clock corrector, and obtained both by the motion of the "I" or block upon the dial, and the sharp sound emitted by it. This we must now omit, as the action is confined to the internal wheel-work; but if desired a second magnet could be introduced to perform this work with greater effect, and might carry a coloured indicator on the dial, and give the signal on a bell.

Our system only corrects a clock which normally gains time, and will not affect it at all if it should go slow. This we think cannot be looked upon as a disadvantage, as even in the event of damage to the wire, or the temporary cessation of the current, the worst which can happen is a mistake upon the safe side, while it may be so little—even one second in a week—as to be quite inappreciable, and would not be known till the work was resumed. There would be no difficulty in introducing an arrangement by which the clock could be accelerated when too slow. A magnet could be so placed as to bring a slight spring into such a position that the pendulum would strike against it at each second vibration, and so cause it to move more rapidly, and the clock to gain time. A disk on the minute wheel would regulate its action. Such, however, would complicate the system, and render it delicate and liable to derangement. Consequently we would not consider the adoption advisable.

The accuracy to which clocks are set depends upon the length of their respective pendulums being measured by the double vibration as a maximum of error. Thus, a clock having a pendulum of about 10 inches long would be set each hour to within one second of time, one with 40-inch pendulum to within two seconds, and one with 14-feet pendulum to within four seconds. These amounts, even as a maximum, would be quite inappreciable in their respective dials, so that it may be said that absolute coincidence would be indicated by all clocks in the circuit.

And why should not all clocks be adjusted in this way? Those in steeples and towers, banks, insurance, public and private offices, clubs, hospitals, schools, shops, warehouses, manufactories, and especially in railway stations and signal-boxes, where, for the safety of the general public, accuracy in time is so essential. This is a matter we think well worthy the attention of our authorities, who, in the interest of the public, would, by correcting the existing public clocks in this way, remove to a great extent the uncertainty and annoyance consequent on their present irregularities, and maintain for Edinburgh the position it has so long enjoyed with respect to time and time signals.

CURIOSITIES OF CLOCKS AND WATCHES.

(Continued from page 5.)

In the year 1698 an Act was passed, 9 William III., c. 28, for protecting both the trade and the public against certain fraudulent impositions then practised by foreigners and others. The second clause of the statute recited that "great quantities of boxes, cases, and dial plates for clocks and watches have been exported without their movements, and in foreign parts made up with bad movements, and thereon some London watchmakers' names engraven, and so are sold abroad for English work; and also there has been the like ill-practice in England by divers persons, as well as by some professing the art of clock and watch-making, as others ignorant therein, in putting counterfeit names, as also the names of the best-known London watchmakers on their bad clocks and watches, to the great prejudice of the buyers, and the disreputation of the said art at home and abroad." For the preventing of such ill-practices it was ordained that no case or dial plate should be in future exported without the movements, nor without the maker's name and place of abode engraven on every such clock and watch, under a penalty of forfeiture and a fine of twenty pounds. In the 27th year of the reign of George II., c. 7, another clock and watchmakers' Act was passed.

The journal of the Clockmakers' Company makes mention of a clock which cost £3 in 1636.

In the churchwardens' accounts for St. Margaret's, Westminster, under date 1617, is an "item, paid to Leonard Tenant, for a new clock and chimes and two dyals, and for a barrel, and pricking thereof, and for wires to the chimes, and for all the iron work, and workmanship in the setting up and finishing of the same, according to an agreement made with him in that behalf, being for the use of this church and parish, £37." And under date 1658 is an "item, to Mr. Farmer, for making of the new diall, on the west end of the church, as by his bill appeareth, £14 10s.;" and "item, to Mr. Farmer, for a new dyall at the west end of the church on the churchyard side, £7."

In the "Monasteriologia" of Stengelius, published in 1619, is an engraving of the monastery of Saints Ulric and Afra, at Augsburg, showing a clock with a bell in a turret over it, in the upper part of a building adjoining the gateway entrance.

An account of the London pageant given in honour of James I., in 1620, tells us that a part of the show "was a chariot painted full with houre glasses and sun-dialls; the fore-wheeles were two globes, and the hinder wheeles were like two church dialls. Within it aged Time was drawne, seated upon an homee glasse."

In the State Paper Office is an inventory of goods which were found in a Jesuits' College in Clerkenwell, in 1627-8; and among the articles enumerated therein are "one strikeinge clocke," and "one hanging watch with an alarum."

In the South Kensington Museum is a table clock in gilt bronze, the sides of which are decorated with allegorical figures in relief, representing impersonations of Arithmetic, Geometry, Music and Astrology. It is of German work, about the year 1640, and was purchased for £6.

So early as the seventeenth century there was in a tower in the grand Piazza at Venice, an old clock, which not only pointed out the hours and their subdivisions, but also exhibited the signs of the zodiac, with the courses of the sun and moon. On certain festivals, and especially every hour while Ascension fair lasted, the statues of an angel and the three kings, or Eastern magi, made their appearance at a door in this clock, and in passing made obeisance to the figures of the Virgin and Child, placed in a niche, and then returned through another door in the opposite side. On the top of the tower were two brazen Moors, or, as Longfellow calls them, "bronze giants," who struck the hours with hammers on a large bell. This piece of clockwork resembled that at Macerata, but the images in the former were larger.

Evelyn, in his "Memoirs," under date 1645, records that while he was at Venice he went "thro' an arch into the famous Piazza of St. Marc. Over this porch stands that admirable clock, celebrated next to that of Strasburg for its many movements; amongst which, about 12 and 6—which are their houres of Ave Maria, when all the town are on their knees—come forth the three kings led by a starr, and passing by ye image of Christ in his mother's armes, do their reverence, and enter into ye clock by another doore. At the top of this turret another automaton strikes ye quarters. An honest merchant told me that one day walking in the Piazza, he saw the fellow who kept the clock struck with this hammer so forceably as he was stooping his head neere the bell to mend something amisse at the instant of striking, that being stunned he reeled over the battlements and broke his neck."

This clock was thus described early in the present century, when it was seen by the writer:—"The Horological Tower is in the splendid square of the Imperial Palace at Venice. It is also called the tower of the clock; it contains the city clock and a bell, with two large bronze human figures, who with huge hammers regularly strike the hours. Midway up the Horological Tower sits a noble bronze gilt figure of the Virgin and the infant Jesus, with an open gallery in front of her, facing the square. On each side is a door opening into the interior. At the striking of the clock, these doors fly open, and several persons move out in succession; the first is a trumpeter who raises his trumpet to his mouth as he comes in front of the Virgin; then follow three others in succession, dressed like Eastern sages, and one of them a person of colour. They all pass in front of the Virgin round to the other side, bowing as they pass; then halting a moment, they straighten up, and entering the other door disappear. This is called the 'Visit of the Magi.'"

(To be continued.)

THE

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PATENTS.

Notices to Proceed.

1003. Frederic Mantle, of Birmingham, in the county of Warwick, Jeweller, has given notice in respect of the invention of "Improvements in snaps or fastenings for neck chains, necklaces, neck ribbons or bands, bracelets, and other like articles."

Grants of Provisional Protection for six months.

2331. John Barnard Jackson and Walter Charles Perrins, of Birmingham, in the county of Warwick, Jewellers and Co-partners, for the invention of "Improvements in bars for Albert or Brequêt chains."

2467. Charles Shepherd, of Alexandra-road, Saint John's Wood, in the county of Middlesex, for the invention of "Improvements in electro-magnetic clocks."

2478. Thomas Johnson Potter, of Clapham, in the county of Surrey, Master of Arts, for the invention of "Improvements in the construction of telescopes."

Patents Sealed.

333. Frederick James Ritchie, of Edinburgh, in the county of Midlothian, North Britain, Watch and Clock maker, for an invention of "Improvements in controlling timekeepers by electricity, and in apparatus therefore."—Dated 25th January, 1878.

Patents which have become void.

2298. William Brockell, of 37, New Bond-street, in the county of Middlesex, for an invention of "A combined collar stud and cravat fastener."—Dated 23rd June, 1875.

2310. Alfred Littlehales, of Birmingham, in the county of Warwick, Engraver, for an invention of "Improvements in fastenings for solitaires, sleeve links, shirt and other studs.—Dated 24th June, 1875.

2335. Auguste Conod, of Lausanne, Switzerland, now of 8, Southampton-buildings, London, Watch and Clock Manufacturer, for an invention of "Improvements in electric clock apparatus, parts of which are applicable to ordinary clocks."—Dated 26th June, 1875.

Patents Granted in Foreign States.

Belgium.

45,244. N. S. Keith, for "Improvements in refining lead, and separating of gold, silver, and other metals therefrom."—Dated 24th May, 1878.—French Patent, 22nd May, 1878.

45,342. L. Bovenrade, of Liége, for "A tool for setting stones in watches and jewelery articles."—Dated 5th June, 1878.

Prussia.

2. Schuster, Brothers, of Polsnitz, for "A regulator clock-work."—Dated 7th December, 1876.—Cancelled 3rd May, 1878.

German Empire.

1669. Bellosa and Mahla, of Pforzheim, for "Rims of finger-rings."—Dated 24th January, 1878.—Class 44.

1681. K. F. R. Volk, of Berlin, for "An appliance for protecting watches from pickpockets."—Dated 17th November, 1877.—Class 44.

United States of America.

200,596. Norman Allen, of Forestville, assignor of one-half of his right to Elbridge H. Lane, of the same place, and E. C. Hamlin, of Plainville, Conn., for "Manufacture of clock-cases."—Application filed 22nd October, 1877.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Hughes Joseph, 104, Minories, late 19, London-st. and Queen's-st., Radcliffe, optician. June 28. Stocken and Jupp, sols., 6, Lime-st.-sq.

Haberstroh, Pius, 37, King's-sq., Goswell-road, late 3, Medway-street, Chatham, watchmaker. June 27. S. T. Cooper, sol., 88, Chancery-lane, London.

Bradbrook, Geo. Richd., 212, Vauxhall Bridge-rd., late Brownlow-st., Holborn, jeweller. July 6. G. S. Tinkler, sol., 111, Victoria-street, Westminster.

Vuilleumier, Jean Charles Prosper, 22, Welbeck-st., Cavendish-sq., watch manufacturer and importer of musical boxes. July 3. A. E. Copp, sol., 37, Essex-st., Strand.

Furneaux, Wm. Saml., 16, Tottenham Court-rd., fancy jeweller. July 4. Weeks & Son, sols., 119, Cheapside.

Whitaker, Benj., 6, North-street, Todmorden, watchmaker. July 1. J. E. Craven, sol., Todmorden.

Barwick, Brice Wilkinson, Thos. Barwick, & John Kaye Barwick, trading as Barwick Bros., Keighley, jewellers. July 1. Wright and Waterworth, sols., Keighley.

Harris, Alfred, High-st., Rhyl, jeweller. July 5. W. R. Williams, sol., Rhyl.

Billyeald, Alfred, 11, Angel-row, Market-pl., Nottingham, jeweller. July 11. Burton, Son & Eking, sols., Nottingham.

Guillaume, Victor Pierre, Spon End, Coventry, watch material dealer July 6. O. Minster, sol., Coventry.

Origoni, Joseph, St. Nicholas-square, Newcastle, jeweller, &c. July 8 Gibsons and Pybus, sols., Newcastle.

Randel, Edwd., 7, Regent-parade, Birmingham, silversmith. July 9. R. J. Parr, sol., Colmore-row, Birmingham.

Hyams, Michael, 29, Alderney-rd., Mile End, late 64, Lincoln-st., Bow-road, optician. July 15. G. J. Jennings, sol., 69, Leadenhall-street, August 7, at 2.

Wilkinson, Joseph, 41, West-st., Sheffield, watchmaker. July 18. Wilson and Clayton, sols., Sheffield.

Nelson, Horatio Walter, 377, City-rd., jeweller. July 3. Crouch & Spencer, sols., 52, Queen Victoria-st.

Wakefield, Henry Thos., Brearley-st. West, & 4, Bangor-ter., Lozells, both Birmingham, goldsmith and jeweller. July 16. A. H. Foster, sol., 13, Bennett's-hill, Birmingham.

Cotterell, Harry, King's Road, Brighton, jeweller and silversmith. July 23. At Inns of Court Hotel Limited, High Holborn, Aug. 13 at 2. R. J. Finnis, sol, 19, Surrey Street, Strand.

Deatheridge, Walter Henry, 9, Villa Street, Lozells, Birmingham, general dealer and jeweller. July 27. At R. Duke's, sol, Temple Row, Birmingham, Aug. 13 at 10.

Alexander, Sylvester Solomon, trading as Alexander & Alexander, 16, Hatton Garden, diamond merchant and jeweller. July 26. At Smart, Snell & Co.'s, 53, Cannon Street, Aug. 8 at 3. Harcourt & McArthur, sols, 13, Moorgate Street.

Foden, Edward Rothwell, 17, Whittle Street, and 185, Great Ancoats Street, both Manchester, watchmaker and jeweller. July 23. At E. Heath & Sons, sols, 41, Swan Street, Manchester, Aug. 13 at 3.

Matthews, William, Main Street, Egremont, Cumberland, watchmaker. July 23. At E. Atter's, sol, Whitehaven, Aug. 13 at 12.

Brown, Jonathan, 49, Clifton Street, Lytham, watchmaker and jeweller. July 26. At J. Thompson's, sol, Preston, Aug. 15 at 3.

Discharges Granted and Bankruptcies Closed.

Rowson, Henry (Bkt.), Exchange-street East, Liverpool, jeweller. Discharge granted July 5.

Dissolutions of Partnerships.

Blewitte & Co., 69, Hatton-grdn., electro-plate manufacturers. May 8.

Britton, B. H. & Sons, Vyse-st., Birmingham, gold chain manufacturers. May 7. As regards Mary A. Britton.

Hirons, Plante & Bourne, Frederick-street, Birmingham, and 12, Hatton-garden, London, electro-plate manufacturers. June 24. As regards Rowland Bourne.

Quilliam & Cooper, Liverpool, watch manufacturers May 11.

Wingrove & Allen, 6, Newcastle-pl., Clerkenwell, jewellers. June 30. Debts by Wm. Wingrove.

Pearce, H. & J., 11, Spencer-st., Birmingham, jewellers. June 3. Debts by Henry Pearce.

Harris & Hague, Furnace-hill, Sheffield, electro-plater. May 15. Debts by Chas. Hague.

Beech, Richd. & Co., Caroline-st., Birmingham, ectro-plate manufacturers. June 27. Debts by Richd. Beech.

Carloss, W. J. & King, 66, Hatton-garden, goldsmiths and jewellers. June 24.

Hart & Co., Ruby-bldgs., Birmingham, electro-gilders. July 5. Debts by Fredk. Salaman.

Trustees Appointed.

Whitaker, Benjamin, (Liq), North Street, Todmordon, watchmaker. Tr., J. I. Learoyd, Halifax, accountant.

Garland, Jas. (Bkt.), Newcastle, jeweller. Tr., R. Ormond, Grainger-street West, Newcastle, accountant.

Lemmon, Chas. (Liq.), 32, North End, Croydon, watch and clock maker. Tr., G. Emdin, 72, Coleman-st., accountant.

Shaw, Jas. (Liq.), Cheapside, Leicester, watch and clock maker. Tr., P. Mackennal, Leicester, accountant.

PREPARATION OF ARTICLES FOR PLATING.

ARTICLES that are to be plated are first boiled in an alkaline ley, to free them from grease, then washed from the ley, and dipped into dilute nitric acid, which removes any oxide that may be formed upon the surface; they are afterwards brushed over with a hard brush and sand, of which a kind obtained from the Isle of Wight, and known as silver sand, is the best. The alkaline ley should be in a caustic state, which is easily effected by boiling the carbonated alkali, and adding slaked lime, until on the addition of a little acid to a small drop of the solution diluted with cold water, no effervescence occurs. The lime is then allowed to settle, and the clear liquor is fit for use. The ley should have about half a pound of soda-ash, or pearlash, to the gallon of water. The nitric acid, into which the article is dipped, may be diluted to such an extent that it will merely act upon the metal. Any old waste acid will do for this purpose. In large factories the acid used for dipping before plating is generally afterwards employed for the above purpose of cleaning. The article being thoroughly cleaned and dried is weighed, and a copper wire attached to it, either by twisting it round the article or putting it through any open part of it, to maintain it in suspension. It is then dipped into strong nitric acid as quickly as possible, washed through water, and then immersed in the silver solution, suspending it by the wire upon a brass rod which crosses the mouth of the vessel and is attached to the zinc of the battery. The nitric acid generally used and found best for dipping has a specific gravity of 1·518, and contains 10 per cent. sulphuric acid, and costs about 3d. per pound. The article is instantaneously coated with silver, and ought to be taken out after a few seconds and well brushed. On a large scale, brushes of brass wire attached to a lathe are used for this purpose; but a hard hair brush with a little fine sand will do for small work. This brushing is used in case any particle of foreign matter may be still on the surface. It is then replaced in the solution, and allowed to remain till it receives the proper coating; in the course of a few hours a coating of the thickness of tissue-paper is deposited on it, having a beautiful matted appearance of dead silver. If it is desired to preserve the surface in this condition, the article must be taken out, care being taken not to touch it by the hand, and immersed in boiling distilled water for a few minutes. On being withdrawn, sufficient heat has been imparted to the metal to cause it to dry instantly. If it is a medal, it ought to be put in an air-tight frame immediately, or if a figure, it may be at once placed under a glass shade, as a very few days' exposure to the air tarnishes it, by the formation of sulphide of silver, and that more especially in a room where there is fire or gas. If the article is not wanted to have a *dead* surface, it is brushed with a wire brush and old ale, beer, or water, containing in solution a little gum, glue, or sugar; but the amateur may use a hard hair brush. It may be afterwards burnished, according to the usual method of burnishing, by rubbing the surface with considerable pressure with ordinary burnishing tools of polished steel, or the mineral termed *bloodstone* (brown oxide of iron).

We may remark, that in depositing silver from the solution a weak battery may be used; though when the battery is weak the silver deposited is soft, but if used as strong as the solution will allow without escape of gas, say eight or nine pairs, the silver will be equal in hardness to rolled or hammered silver. If the battery is stronger than the solution will stand, or the article very small compared to the size of the plate of silver forming the positive electrode, the silver will be deposited as a powder. The average cost of depositing silver in this way, using three pairs of zinc and copper, is 2d. per oz. Gas should never be seen escaping from either pole; and the surface of the article should always correspond as nearly as possible with that of the positive electrode, otherwise the deposit runs the risk of not being good; it requires more care, and the solution is apt to be altered in strength, because if the positive electrode be large compared with the negative, the solution will become stronger in silver, while if smaller in proportion, the solution will become exhausted of silver.

In plating large articles, especially old articles being replated, as well as new articles with large surface, it is not always sufficient to dip them in nitric acid; wash and immerse them in the solution, in order to effect a perfect adhesion of the two metals, there being a tendency, in the time required, to slight oxidation. To secure perfect adhesion, a small portion of quicksilver is dissolved in nitric acid, and a little of this solution is added to water, in sufficient quantity to enable it to give a white silvery tint to a piece of copper when dipped into it; the article then, whether made of copper, brass, or German silver, is, after being dipped in the nitric acid and washed, dipped into the nitrate of mercury solution till the surface is white; it is then well washed by plunging it into two separate vessels containing clean water, and finally put in the plating solution. One ounce of quicksilver thus dissolved will do for a long time, though the liquor is used every day. When the mercury in this solution is exhausted, it is liable to turn the article black upon being dipped into it. This must be avoided, as it causes the deposited metal to strip off; the only remedy is a new solution of mercury.

For the above practical directions we are indebted to Mr. James Napier, F.R.S.E., F.C.S.

Mr. W. A. Ross, in a communication to *Nature*, says:—"It may perhaps interest your readers to know that pure alumina dissolved nearly to saturation before the blow pipe in an *acid* flux, such as a bead of phosphoric acid, invariably causes that to assume a pale but beautiful sky blue on cooling. In an *alkaline* flux, such as a bead of boric acid, containing sufficient soda to dissolve it to saturation, alumina causes the bead to assume a pale red colour on cooling. The greatest care has been taken to ascertain that the materials are absolutely free from any metallic or other oxide which might produce such colours, and the resulting beads have been shown to several gentlemen, as Messrs. Hunt and Roskell, Mr. Hutchings, of Frieberg, and others. Might not these facts then afford us some clue (so much wanted) to the cause of colouration in the sapphire and ruby?"

ON THE MANUFACTURE OF NICKEL.

By H. Lundborg.

THE alloy of copper and nickel, though but a raw material for the manufacture of German silver, is nevertheless called refined nickel, provided it is free from impurities. The amount of nickel in the alloy for galvanic plating varies from 4 and 5 to 12 and 15 per cent.; the higher it is the greater the hardness, and the lighter the colour of the deposit. Refined nickel is sold as nickel powder, as cube nickel, and sometimes as grain nickel. It consists of alloys of copper and of nickel with more or less of cobalt, the percentage of nickel varying from 50 to 95 per cent.

In the manufacture of German silver even 1 per cent. of iron in the alloy is said to be injurious, and sulphur to the extent of one-tenth per cent. of the nickel similarly affects it.

The establishments of Germany and Austria work almost exclusively raw material from foreign countries, in the shape of ores and mattes from Sweden, Norway, Piedmont, Hungary, and South America. Though the ores do not often contain much sulphide of iron, wet treatment is employed in but one locality. Arsenical ores are smelted for speiss; for ores containing chiefly sulphur, the ordinary Sulu method of smelting is used, which produces a matte containing more or less nickel and cobalt. This matte is either concentrated by repeatedly roasting and smelting, in order to slag the iron, or the crushed matte is roasted, dissolved in acids, and its oxidised constituents separated in succession by different precipitants.

The final products obtained by either of these methods may be grain or powder, varying in their percentage of nickel, and cubes, which, when made in the dry way, hold 60 to 80 per cent. of nickel, but which are, it is said, by the reduction of oxide of nickel precipitated in the wet way, made as pure as 95 to 98 per cent. Finally, they produce colours of nickel and cobalt salts, which are obtained exclusively by precipitation from solutions. Many different colours are made which find daily extending use in the manufacture of glass and porcelain.

At the Victoria Works, in Silesia, a concentrated matte from Sägmyra, in Sweden, almost free from iron, is treated. It is crushed by iron stamps to particles of two millimetres in diameter, then roasted for twelve hours, ground fine, and roasted again for twenty-four hours. The final roasting is effected in a hexagonal reverberatory furnace. Below the refractory hearth upon which the material is spread out there is a grate for wood reaching across the entire furnace. The flame enters the centre of the furnace by a vertical flue and spreads out in all directions. The products of combustion escape through flues in the corners of the furnace. The six working doors permit an easy and thorough rabbling of the material.

From the roasted powder, consisting chiefly of oxides and sulphates of copper, nickel, and some cobalt, so much oxide of copper is extracted by warm dilute sulphuric acid that the residue will furnish nickel cubes holding 80 per cent. of nickel. The amount of oxide of copper to be extracted is determined by an analysis of large lots of the material. The works sell their product to German silver manufacturers in England, who, in order to avoid interminable calculations, desire a constant percentage (80, of nickel.

In extracting the copper there should be an excess of oxide of copper, so that any oxide of nickel which may have been dissolved is precipitated as soon as the liquor is stirred and is replaced in the solution by oxide of copper. The latter is drawn off, evaporated, and blue vitriol crystallised from it.

The residue from the extraction of copper is washed with water, dried, ground again, roasted for twelve hours, mixed with a thick paste of flour and water, and dried on a copper plate. As soon as the mass has become tough and coherent, it is cut into cubes with a knife; these are dried and reduced in plumbago crucibles with charcoal powder.

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HOROLOGY.

(*Continued from page 2.*)

XXXVI.—THE PENDULUM.

THE other method is to set a pendulum in motion, to measure with the greatest care the number of its vibrations, and also its length at the time of the experiment; then to deduce the length of a single pendulum beating seconds at the same station. The lengths of the pendulums beating seconds in different places, compared with each other, enable us to calculate the ratios which exist between the intensity of the force of gravity at those places.

We possess a great number of observations made by one or other of the two methods in various regions of the two hemispheres, from the seventeenth century to the present time. The most illustrious men have associated their names with these investigations, which are of such importance to the physics of the globe. One of the best-known pendulums is that employed by Borda, celebrated for the accuracy of his researches. The pendulum was formed of a ball of platinum suspended by simple adherence, and by the aid of a metal cap lightly covered with grease, to a fine metallic wire, which was attached at its upper extremity to a knife-edge similar to that which supports the pendulum-rods of clocks. The knife-edge rested on two well-polished fixed planes of hard stone, the position of which was perfectly horizontal. These planes were themselves fixed to a large bar of iron attached to supports fixed in a solid wall, in such a manner as to obtain perfect immobility. The oscillations were corrected by comparing them with those of the pendulum of a clock placed against a wall, the movement of the clock being regulated by the stars. By the help of a telescope placed at a distance of ten metres, the successive coincidences of the two pendulums were observed, and from the number of the coincidences and the number of seconds elapsed the number of oscillations was deduced. This number having been thus ascertained, the length of the pendulum was measured by operations of the greatest delicacy, the details of which cannot be given here. They will, however, be found in Vol. II. of Biot's "Physical Astronomy." Having stated the length of the pendulums beating seconds at Paris and London, we will now give the length which calculation and observation have determined for similar pendulums located at the poles, equator, and at a mean latitude of 45°; the intensity of the force of gravity in these different places—that is to say, the number of metres indicating the velocity acquired in a second by heavy bodies falling *in vacuo*—is also shown.

	Length of the Seconds Pendulum. mm.	Intensity of the Force of Gravity. m.
At the Equator	991·03	9·78103
At the Latitude of 45°	993·52	9·80606
At the Poles	996·19	9·83109

It must not be forgotten that the variation of the force of gravity in different parts of the earth depends, as we have before said, both on the form of the globe, which is not spherical but ellipsoidal, and on the centrifugal force engendered by the velocity of rotation. The force diminishes therefore from the poles to the equator more than it would do without this rotation. But we know what proportion must be attributed to each of these causes in the phenomena observed. By the aid of pendulum observations it has been found possible to calculate the flattening of the earth, and to demonstrate in this manner the results of geodetic operations, as well as Clairaut's hypothesis on the increasing densities of the interior strata from the surface to the centre.

By careful comparisons of pendulum oscillations, executed in different regions of the globe, it has been found that they sometimes indicate a force of attraction much greater than that given by calculation; while in other regions the intensity is, on the contrary, more feeble than the elliptical form of the earth would require. As the excess of the action of gravity has been observed especially in islands situated in the open sea, whilst the opposite is found to be the case on the coast, or in the interior of continents, it has been concluded that the water-level is somewhat depressed in the middle of the ocean, and that it rises in the vicinity of large extents of land. Here, then, we find the pendulum indicating inequalities in the curvature of the terrestrial spheroid. By observing the difference of the pendulum which beats seconds at the top of a very high mountain and at the level of the sea in the same latitude, the density of the globe may be arrived at. Another similar method which has been employed consists in observing the oscillations of the pendulum at the sea-level and at a great depth in the interior, or at the sea-level and at the top of a high mountain. Sir J. B. Airy made some experiments in the Harton mines on the vibrations of two pendulums placed, one at the surface, the other at the bottom of the mine, at a depth of 420 yards. The latter moved more quickly than the upper pendulum, and its advance of two seconds and a quarter in twenty-four hours showed that the intensity of the force of gravity was increased from the surface of the earth to the bottom of the mine by about $\frac{1}{20000}$th part of its value. This result proves that the density of the terrestrial strata increases from the surface towards the centre; since, if it were otherwise, the attraction due to the interior nucleus would diminish with depth, and the oscillations of the pendulum would be more and more slow, which is contrary to the fact. The density of the strata comprised between the surface and the bottom of the mine being known, and the connection between this density and that of the nucleus being deduced from the accelerations observed, the mean density of the terrestrial globe may be calculated.

We see thus that the pendulum is a most important instrument to the scientific world, but its most valuable application has been to the measurement of time, and we shall in our next article speak of the pendulum as applied to the measurement of time.

A Magnetic Lock.—One of the most ingenious forms of lock now made, known as the magnetic, is constructed without a keyhole, with changeable key, and is useless to all but the owner. It is made of brass, or some non-magnetic metal, the harder the better, and four circular metallic pieces, having the adjustable magnets centred rather tightly in them, are suspended on pivots, which allow of rotation with sufficient ease, and each has a groove nearly to the centre, to admit the four prongs of the bolt in unlocking, the whole being nicely balanced. There being no spring, and the bolt only required to slide easily, the handle must be allowed to turn in its centre when the force used would exceed what is necessary to slide the bolt.

TO FIND THE NUMBER FOR A LOST WHEEL AND PINION.

To find the number for a lost wheel and pinion, the number of revolutions the escape-wheel makes in an hour must first be ascertained. This can be done by counting the vibrations of the balance and spring belonging to it. Two vibrations are made (by a lever) to every tooth of the escape-wheel; ordinarily 14,400 are made to one revolution of the centre-wheel (1 hour), two vibrations to a tooth, and fifteen teeth to the wheel, give thirty vibrations to one revolution of escape-wheel, gives 480 revolutions of the escape-wheel in one hour. Assume the train to be made up of—

Centre wheel	...	...	80 teeth,	pinion 10 leaves.
Third ,,	...	...	75 ,,	,, 10 ,,
Fourth ,,	...	. .	64 ,,	,, 8 ,,
Escape ,,	...	...	15 ,,	

Multiply the number of revolutions of escape-wheel, 480, by the number of leaves in its pinion, $\frac{8}{3840}$, the number of leaves that must pass in an hour. Imagine the fourth wheel and pinion gone, which leaves a gap in the computation sought to be filled. Now begin computation at the centre wheel, which turns the third wheel pinion (of 10) eight times in an hour, which causes a passage of 8 × 75 (teeth of the third wheel) = 600, which brings us up to the lost (fourth) wheel, which wheel, with its pinion, must bring the number of teeth passing up to the escape-wheel pinion (which we found to be 3,840). Now this number, 3,840, divided by 600 (the number produced by the train up to the lost wheel), gives $6\frac{2}{5}$, which will be the multiplier to any pinion you choose to put in the place of the lost one, viz., pinion of 10 × $6\frac{2}{5}$ = 64, the number of teeth required in the wheel if you use that pinion. If you assume the pinion to be 8 × $6\frac{2}{5}$, it will give you $51\frac{1}{5}$ for the number of teeth in the wheel, which is impossible, being fractional. Take for illustration another train, which beats seconds 3,600 to the hour, gives 120 revolutions to the escape-wheel, the train being

60	...	...	Centre wheel	
50	...	...	Third wheel,	pinion of 10
40	...	...	Fourth wheel	,, ,, 10
15	...	...	Escape-wheel	,, ,, 10

One hundred and twenty revolutions of the escape-wheel, multiplied by ten leaves in its pinion, produces 1,200; the fourth wheel being lost, we must go back to the centre wheel, and reckon the teeth up to the lost wheel, which will be 300, making the fourth wheel and pinion $\frac{1200}{300} = 4$, the multiplier for the lost wheel. We can use a

Pinion of	1½ × 4	gives a wheel of	6	teeth.
,,	12 × 4	,, ,,	48	,,
,,	8 × 4	,, ,,	32	,,
,,	6 × 4	,, ,,	24	,,

Either one of these wheels and pinions will fill the requirements, but a pinion of six or eight would be too small, and one of twelve too large. Consequently ten and forty are the proper numbers.

By the same process the numbers for any lost wheel of the train can be determined; the size can be got from the old holes, or it may be calculated; the radius of the wheel and pinion should be to each other as the numbers of the teeth in the wheel and pinion.

WATCH TRADE IN ENGLAND.

England imported foreign watches to the amount of £151,061 in 1875; £450,062 in 1876; £503,975 in 1877. Exported were: 518,466 watches in 1875; 601,013 watches in 1876; and 687,714 watches in 1877, representing a value of £405,150, £447,157, and £514,143 respectively.

JEWELLERY.

By George Wallis.*

THE love of personal decoration is inherent in man, and is characteristic alike of the condition of savage and civilized life. We have no record of a people, however primitive, in whom the desire for ornament of some kind has not existed, and did not manifest itself in some tangible and unmistakable form, either by tattooing devices on the body itself, or suspending to the ears, nose, and lips, metal or other ornament, either by perforation of the cartilage or by pressure. The decoration of the head, by a bandage across the forehead; of the neck, by a collar; of the arms and wrists, the legs and ankles, and finally the fingers and toes, appears to grow by a systematic order of procession, from the minutest ornament up to the most redundant and elaborate display of the jeweller's art, as seen amongst the wealthiest orientalists of past and present times. Nor would it be very difficult to trace in the intricate tattooings or "caste" marks of semi-savage peoples, the basis of design on which the general forms, and especially the minuter details, of the jewellery of a later condition of social and domestic life have been grounded. The use too of suitable natural objects, such as shells, seed vessels, seeds, feathers, drilled stones, either singly or in repetition and combination, has been largely suggestive of an important class of personal decorations produced in metal, especially amongst the people of the East.

It would probably be too much to say that the more primitive peoples had always some representative purpose in what they wore in the way of personal adornment; but that they appear to have had an instructive appreciation of the fitness of what they wore for the purpose for which they wore it, may be safely asserted; indeed, just as much as the tattooed badges of the chieftain recorded his deeds and marked his rank in his tribe or "nation," or the decorations of civilized society mark the conventional position or the actual public services of the wearer.

In thus indicating a common origin, however remote, for much of the personal ornament used and worn under varying conditions by every people in the world, it is not by any means intended to set aside the fact that the application of decorative design, in form and detail, to the instruments necessary for fastening clothing upon the person of the wearer, has not largely influenced the nature of the materials selected, the character of the contrivance, and the outward form and appearance of innumerable objects in use from the earliest periods down to the present time, and to which the generic name of jewellery is now given.

A jewel is not necessarily an object of use, but it must be one of precious material, or materials fitted for use as a personal ornament. The word is said to come to us through the French from the Latin *gaudium* (joy), *jouel, joyau;* and though it is sometimes used to describe a single precious stone, it is not in this sense that I intend to use it, but in its wider and more general signification.

As in many other matters connected with the industrial arts, we turn to ancient Egypt for the earliest illustrations of working in gold, and the use of vitreous substances for giving variety of colour in combination with fitness of form to use, and to enhance the expression of the symbol which invariably suggests the basis of the design. The Egyptian mode of sepulture has been the means by which admirable examples of the jeweller's art, as practised long prior to the existence of such an industry amongst any other people of which we have record, have come down to us. The fact that the most cherished and valuable personal ornaments of the dead were buried with them in sarcophagi, lavishly decorated, preserved these valuable illustrations of the manners and skill of a people long since passed away, as shown in the International Exhibitions of 1862 and 1867, by the remarkable collection of Egyptian jewellery belonging to the Khedive of Egypt. These were discovered by M. Mariette near Thebes, and were taken from the coffin of Queen Aah Hotep, found at the entrance of the valley of the Tomb of the Kings.

As might be expected, this jewellery partook in its design and execution of all the leading characteristics of the arts of a people, which had left such extraordinary monuments of greatness and power behind them. They showed unmistakably that the artificers who produced them were well acquainted with various handicrafts of hammered work, chasing, and soldiering; that they had full knowledge of and mastery over the processes by which inlays of coloured materials were used as an adjunct to the gold, or in which the gold itself was subordinated and simply used as a vehicle for displaying colour, and that like all the Oriental peoples of later times, they had used the means at their disposal, to imitate or suggest the effect of the combination of precious stones, which, if abundant, were not so well adapted to the special purpose they had in view, since their artistic imitation in vitreous substances was more under command for the purposes of surface decoration. We shall see in due course how this system was carried out in later times and with what extraordinary results.

The only record of any value of the use of jewels, or jewellery, by the Assyrians, is found in the bas-reliefs of this ancient people. Their use of personal ornament is here shown in a very distinct manner, but we can know nothing of the character of the workmanship.

Discussing the question as to whether the Phœnicians were manufacturers as well as merchants, since specimens attributed to them have been considerd as more likely to have been early Asiatic Greek, the gold trinkets and jewellery of the Etruscans present the first practical lesson after the Egyptian. The specimens of the handicraft power of Etruscan goldsmiths and jewellers, which have come down to us, show a skill in these arts some six or seven hundred years before the Christian era which is not surpassed, and in some respects cannot be equalled, by any modern workers in gold; and our method of decorating, or giving tone and richness to the surface of the metal by granulation of that surface, has only recently been attempted to be imitated with a certain measure of success. Signor A. Castellani, of Rome, has attempted to revive the old Etruscan methods, and in this he has been assisted by the tenacity of tradition amongst the workmen living in the Abruzzi, and by bringing their skill and methods handed down from generation to generation, to bear upon modern wants. Castellani's examples of this class of jewellery in its recent revival by him, exhibited in the Metropolitan Museum of Art, were remarkable specimens of past methods, successfully applied to meet modern wants and ideas in the most refined and elegant form.

As might be expected, the Greeks left their impress upon an art in which refinement in design and skill in handicraft power has so much to do with success; but then it was with them, as it unhappily is *not* with us, that the designer and the workman were united in one person. Thus the thought and its realization were one. The Greeks excelled, as might be expected, in the character of the models selected, in the finish which they brought to bear upon the work of chasing, in the remarkable manner in which they united by soldering the thinnest pieces of metal, as also in their intaglio work; whilst they also used the granulated surfaces already spoken of in connection with Etruscan work, and with equal success. The freedom with which the Greeks treated the forms they adopted in their objects of personal decoration is remarkable, and in this they simply took skilful advantage of the thinness of the metal, to avoid the most rigid treatment required in greater masses of material.

(*To be continued.*)

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* British Manufacturing Industries.

THE FRENCH WATCH AND CLOCK TRADE IN 1867 AND 1878.

MONS. CLAUDIUS SAUNIER, in the *Revue Chronométrique*, makes an interesting comparison between the state of trade in these branches at the times of the last and the present exhibition.

He estimates that France manufactures *heavy* clockwork, such as turret clocks, &c., to the amount of £100,000 a year, an increase of £20,000 on the production of 1867. Mons. Saunier claims that French public clocks are superior to those made in any other country, excelling not only in perfect workmanship, but also in judicious mechanical combinations. This branch of the trade is not confined to any particular town or department, about fifty manufacturers being established in various parts of France, many of them, however, only on a small scale; and the lion's share of the business falls to a small number of Parisian and two or three provincial firms.

The centre for the manufacture of *medium* clockwork, such as Comté clocks, turnspits, and ordinary regulators, is the canton of Morez. The town of that name, with 5,000 inhabitants, does a very brisk business in this line, employing about 6,000 hands living in the neighbourhood, besides a large number of its own population. These Comté clocks are said to be greatly superior to the Black Forest productions, and 100,000 of them were turned out in 1867, representing a sum of four millions of francs. The annual production of Morez is now stated to be 70,000 Comté clocks, 30,000 turnspits, and 20,000 pendules, part of the latter being travelling clocks. We have, therefore, a falling off in the clock business, a loss which is, however, more than made up by the addition of the pendule branch. Some of the leading firms of this town sell also watches, which they draw principally from Besançon.

French clocks (pendules) to-day, as in 1867, are a combination of different elements, manufactured in various parts of France. Beaucourt-Badevel, Montbéliard, a few localities in the Jura, and Saint Nicolas d'Aliermont, near Dieppe, construct the movements called *blanc-roulants*, or simply *roulants*, that is the frame of the movement with its wheelwork. Some of these movements are provided with an escapement, finished and placed in cases either at Beaucourt or at Morez, others are sent abroad in their unfinished state, but the greatest number find their way to Paris. There they are supplied with escapement, dial, hands, &c., finished off, fixed in cases, which Parisians politely call cabinets, in wood, bronze, or brass, and then redispatched to all parts of the world. The cylinder, anchor escapements, &c., with circular balance, employed in portable clocks are drawn from the neighbourhood of Montbéliard, Morteau, and the watchmaking districts adjoining Switzerland, while the escapements adjusting to pendulum or rectilinear balance, by far the most numerous, are manufactured in Paris.

According to some figures which were submitted to the members of the jury in 1867, the factories of Beaucourt-Badeval (Japy frères) of Montbéliard (Roux & Cie., Marty & Cie.), and of Berne-Seloncourt (Louis Japy), turned out about 170,000 clock movements in 1856, the work of 2,000 to 2,500 hands, and representing a value of two millions of francs. This large production, at such a comparative small cost and labour, is principally due to the employment of machinery. Mons. Monnin-Japy, in a communication to Dr. Muston, of Paris, in 1857, states that Paris alone had bought 140,000 of those movements, and that the remaining 30,000 were sent abroad rough, or finished and mounted in the establishments of the Doubs and Jura. It is reported that this branch of clock-making has since then been transplanted to the Departement du Doubs, where the manufacture of clock movements, especially for travelling clocks, has assumed large proportions, and the official catalogue of the Exhibition of 1867 estimates the annual production of movements of the Upper Rhine and Doubs at 200,000. Montbéliard exported in 1867, in addition to the numerous quantity of movements, about 30,000 musical boxes, of which one-third went to England and America, one-third to Germany and Russia, and the rest to other parts of the globe. The leading establishment in this line is at Sainte-Suzanne, near Montbéliard, founded by Mons. Lépée. In 1878 the factories of Montbéliard have still further extended, the actual production being 400,000 movements for clocks, telegraphic apparatuses and gauges of all kinds. In this estimate are included the small, completely finished and superior clocks, brought into the market by Messrs. Japy frères with a view of displacing the *cheap clocks*—in the report from which we quote styled "atrocious trash (*l'atroce camelote*)"—of the Germans and Americans. About 18,000 of the small movements for travelling clocks are turned out annually in this district, and the manfacture of musical boxes has also gained larger dimensions. The trade of Montbéliard, which amounted to about seven millions of francs in 1867, is now said to be over nine millions.

Our authority next deals with the district of Saint Nicolas d'Aliermont. The situation in 1867 was as follows:—Of the 2,500 inhabitants residing in this locality, about one thousand were employed in horological pursuits. They manufactured chronometers, scientific regulators, the better class of clock movements, especially for travelling clocks, alarums, electric apparatuses, &c.; and according to information gathered in the district, about 144,000 movements of various sorts were made during the year, worth a little over a million of francs. The largest share of their manufactures went to Paris, the next best customer being London. About 50,000 kilos. of metal, nearly all brass, were employed in the construction of these 144,000 movements. The watch and clock makers of St. Nicolas worked formerly at their own homes, the same as their fellow-craftsmen in Switzerland did, and still do in some parts; but the severe competition of the Jura forced the manufacturers of Saint Nicolas also to adopt the new mode of production, and to introduce machinery, necessitating the erection of large workshops, where the artisans work under the direction of *chefs* and overseers. Women are also employed, and such jobs as polishing, pivoting, and mounting of wheels are allotted to them. Saint Nicolas has also made progress since 1867, the means of production have been perfected, and business has increased from one million of francs to a million and a half.

When speaking of the clock-trade of Paris, Mons. Saunier states that that city, like other horological centres, such as Geneva, Besançon, Locle, La Chaux de Fonds, &c., does not produce the principal elements of a clock itself, but imports them from the localities already mentioned. Paris does only the finishing and casing, and then brings them into commerce under the name of *Paris clocks*. "Those emanating from our good makers," says he, "are unrivalled for perfect movements and tasteful exterior, but unfortunately, here as elsewhere, good makers are not the most numerous. We construct chronometers and regulators and artistic time-pieces which are really remarkable, bearing the stamp of excellence and taste, but the number is *very limited.*"

In 1867 Paris had about 3,700 watchmakers, to which may be added the greater part of workmen employed at telegraphic apparatuses. Employers and assistants formed a population of 4,000 industrials, whose trade, amounting to 20 millions of francs in 1860, supplied a livelihood to at least 20,000 persons. After allowing for the cost of the *roulants*, for watches sold by jobbers, for materials from the factories, together about 5 or 6 millions of francs, we have still from 14 to 15 millions as the profits and salaries of Parisian watchmakers. The above figures are given on the authority of the Chamber of Commerce.

The Paris of 1878 is the great market of the watch trade, although it manufactures but little, and buys what it sells in Besançon and Switzerland. It remains, however, still the centre of the pendule manufacture, an industry which has rapidly grown these last few years; and the *Quartier du Marais* (the Clerkenwell of Paris) can boast of an annual production of a quarter of a million clocks and over 300,000 alarums, lamp-movements, compteurs, &c. The telegraphic apparatuses, the movements of which come from the Franche-Comté or Saint Nicolas d'Aliermont, are also finished in Paris. Another branch of horological industry has become very important in Paris, viz. the manufacture of watch materials, comprising pendule anchors, springs, hands, dials, and a variety of other pieces, which are used in the finishing process of movements and cabinets, and of all those numerous and variously shaped frames for alarums and cheap clocks. The present horological population of Paris is computed at about 8,000 (2,000 masters and 6,000 employés), and the amount of business at twenty-three millions of francs.

The production of chronometers and scientific time-pieces seems to have remained stationary in France, and Mons. Saunier says that his report on the subject in 1867 holds good to-day.

All the component parts of chronometers, &c., were at one time made in Paris, but such is not the case now, and this class of work, particularly the movements, is almost monopolised by Saint Nicolas. Some few of the Parisian chronometer makers still construct their own escapements, but all the rest buy their chronometers completely finished, and have no other trouble than to observe and to regulate them. It is true this operation is the most delicate, requiring precision and a certain amount of experience; and a good financial position will no little contribute to success, as it is desirable to keep and observe these time-keepers for a considerable time before offering them for competition or for sale. Watchmakers who devote themselves to the adjustment or superintend the manufacture of such delicate time-keepers are more artists than artisans. Chronometers of good French makers will stand comparison with the best English ones, which Mons. Saunier calls excellent. He attributes the limited extent of French chronometry to their long wars and maritime disasters, by which English makers profited; he thinks, however, that the *ateliers* of Saint Nicolas would give a great impulse to this art were it not for the want of markets, which have long been flooded with English products.

The report finishes with a review of the French watch trade, from which we cull the following facts.

The watch movements are manufactured at Beaucourt, Montbéliard, Cluses, and a few other less important localities. Messrs. Japy frères, of Beaucourt, turned out 640,000 movements in 1865, worth one million and a half of francs. About 140,000 of these movements were bought by Besançon and the rest went to Switzerland. The district of Montbéliard, particularly the valley of Seloncourt, supplies another 215,000 movements annually, and a large quantity of pinions, of a total value of 700,000 francs. Besançon and Switzerland being again the purchasers. The business of the above-mentioned districts has augmented since 1867 to the extent of about a third, the annual production being a million and a half of movements; just now trade remains, however, stationary, owing to the commercial crisis which the Swiss watch trade has been undergoing these last two years. Cluses, which is the depôt of the horological industry in the Departement of Upper Savoy, suffers from the same cause, and the present production shows but little advance on that of 1867 (1,400,000 francs in 1867, 1,500,000 francs in 1878).

Switzerland has always been the best customer for French movements, and out of 950,000 movements and over a million sets of pinions manufactured in 1867, 700,000 movements and an equal member of assortments of pinions were exported to that country.

Our correspondent at the Exhibition, in his letter published in the July number of our journal, has already acquainted our readers with the progress and present state of the watch trade in Besançon and the Departement du Doubs, and it only remains for us to state that the French watch and clock trade, taken as a whole, has considerably improved since 1867.

A FEW PRACTICAL HINTS FOR ASCERTAINING THE IDENTITY OF GEMS.

In the first place it may be taken as a general rule that stones, either rough or cut, which are affected by the file are not precious stones; and to persons who are accustomed to its use, the difference of the resistance, and of the grating sound occasioned, affords a fair criterion of hardness. In the use of this tool, however, care must be taken not to file the delicate edges, as even the diamond, the hardest of bodies, might chip if subjected to the tool on the girdle, which is as thin as the edge of a knife. For example, supposing it were wished to ascertain what gem a white stone was, if it were scratched by a sapphire, it would at once be evident that it could not be a diamond; if its specific gravity were less than 3·9, it could not be a ruby or sapphire; if it did not acquire electricity by heat, it could be neither a topaz nor a jargoon; and if it scratched glass, it would be seen that it must be either a beryl, or quartz, or rock crystal. For the purpose of ascertaining these facts a crystal of sapphire (which may be obtained easily and without expense), a piece of quartz or rock crystal, a piece of hard flint glass, and a pair of scales for the purpose of taking the specific gravity, are all that is necessary. Those persons who are in possession of an electrometer or a polarising apparatus have valuable adjuncts to the simple tests here indicated. A very common mode of fraud practised on persons inexperienced in cut stones is the "doublet" or semi-stone. In this case the top of the stone is genuine, and the under part glass, joined together artistically with cement; sometimes, for instance, the top is sapphire, and the under part a gem of less value, such as garnet. When set, these stones are very difficult to detect, and frequently deceive the most experienced. When the under part is of glass, however, the application of the file to the under as well as upper surface will, of course, at once show the imposition. Set stones which are set with a back are generally of pale colour or small lustre, often set with coloured foil to enhance their beauty. Sometimes, however, stones which are set open, or, to use the technical term, "azur," have the interior of the setting enamelled or painted, to throw a tint of colour into the gem; or, in the case of the diamond, have the inside of the setting of polished silver, to correct a yellowish tint. In all these cases to be forewarned is to be forearmed, and a careful examination will prevent any one being deceived by these means. In the case of pearls, which are frequently imitated with marvellous skill, it will be seen that false pearls are much lighter than real ones; that generally the former are brittle (although some are made solid, of fish-scales, and do not break so easily), and the holes, which in the real pearl are drilled very small, and have a sharp edge, in the false are larger, and have a blunt edge.

We hear that the Japanese at the Paris Exhibition have purchased a large vase from Messrs. Tiffany and Co., of New York. The vase in question is a specimen of the Mokamea, or imitation of the grain of wood in metal work. The manufacturer takes threads of gold and silver of varying thickness, and hammers or rolls them into a plate of blackened silver so firmly that they form a very part of its substance. The plate is then rubbed down, and the surface shows a richly varied grain.

A Monster Find.—*The Diamond Fields Advertiser* says:—"Messrs. Tracey Brothers have taken a diamond of 194 carats from one of their claims in the Kimberley Mine. It was first discovered by a native, who tried to cover it with his blanket, but the eye of the overseer was too quick for him. The diamond has been sent to the Paris Exhibition."

TRADE RECIPES, &c.

Fitting Centre Pinions.—The best way to fit the hole to the arbor of the old square is to make a "rose drill" of the exact size of the *smallest* diameter of the square arbor where it comes through the pinion under the dial. The "rose drill" is made from a piece of steel wire fitted to the drill stock. Turn down the end of the wire for about the sixteenth of an inch to the exact size you wish the hole through the pinion; above that turn down a shank, a little smaller, only to give perfect freedom, but not enough to weaken the drill; then round off the *end* nicely to a half-round or less, and file the rounded end into a series of radial grooves, all brought to cutting edges; then harden and temper, and you will have a drill which will surely follow the hole you wish to open. Be careful to have the straight part of the drill *no larger* behind than at the end, otherwise it will bind. This drill will not deviate from the centre of the hole it follows, for the smooth sides form a perfect guide. To give the hole the requisite taper to fit the arbor, a very little opening with a $\frac{5}{4}$ brooch (holding the pinion in the fingers) will be sufficient.

Drilling Glass.—Mark the spot on the glass where the hole is desired with a diamond point, or the sharp corner of a piece of steel, as hard as fire and water will make it. It must be sufficiently deep to hold from slipping the end of a copper wire, which must be charged with emery (about No. 60) and water. The size of emery will depend somewhat on the size of hole you wish; for a small hole coarse emery will not stay with your drill; you can run the drill by a drill-stock and bow, or by a lathe. Glass differs very much in hardness, depending upon its composition, some being very difficult to drill nicely, except with No. 1 diamond dust. The hole, when through, can be enlarged at pleasure by using a copper wire, sharpened at such an obtuse angle as not to bind in the hole, and charged with emery the same as for drilling. To prevent chipping, work from each side of the glass alternately. The most expeditious way is with a diamond drill, which is, however, not always at hand.

Oxide of Chromium Bronze.—A beautiful gold-beetle coloured bronze may be prepared in the following manner:—Mix equal parts of table-salt and chromate of potash; let the powder be finely mixed and passed through a sieve; this powder is then put in a crucible, and covered with a layer of salt. The crucible is covered, and the contents allowed to boil for half-an-hour. After cooling, they are carefully washed out with water, and the mass, on being rubbed, will show a beautiful bronze.—*Metallarbeiter.*

Mending Platinum Crucibles, &c.—Mr. Thomas Garside, F.C.S., in a letter to the *Chemical News*, says:—Some months ago I had a platinum dish, which had a small hole in the side near the bottom, and the dish was consequently useless for most purposes. I was about to consign it to the old platinum, when it struck me that this metal being "weldable," I might manage to repair it. Having already a mould for this dish, made of plaster of Paris, and not of wood, this served admirably as an anvil. I then cut a piece of moderately thin platinum foil, about 3 mm. diameter, and rubbed this and the part of the dish where the hole was with sea-sand until perfectly bright and clean. Having fixed the dish and its mould in an upright position, I laid the platinum foil over the hole, and forced the flame from a table blow-pipe upon the spot. A pair of scissors served as a hammer, and by gently tapping with these, the two pieces of platinum united perfectly, and made so neat a joint that one would scarcely observe it unless one's attention was called to it. I have used the dish for all kinds of purposes since, but the union is as good as ever. In the above operation the plaster of Paris mould, although very dry, was split and cracked by the heat in all directions, nevertheless it had sufficient cohesion to last until the operation was concluded. I find that platinum wires are very easily joined in this way."

To Cover Zinc with Coloured Coatings.—Dr. L. Stille describes a chemical process for effecting this purpose in the *Engineering* and *Mining Journal.* The articles of zinc are first brightened by vigorous scouring with quartz sand, moistened with diluted muriatic acid, putting them quickly in water, and then wiping dry most carefully with white blotting paper. To insure success, however, it is necessary to employ zinc as free as possible from lead, and to have it bright like a mirror. When these conditions are fulfilled, the metal may be coated with a variety of most beautiful colours by immersion in a solution of alkaline tartrate of copper for a shorter or longer interval of time, depending on the colour that is desired. The solution is made by dissolving three parts of air-dried tartrate of copper in caustic soda lye containing four parts of hydrate of soda to 48 parts of water. If the zinc is dipped in that liquid at a temperature of 10° Cels. (—40°·Fahr.), it appears violet after two minutes, takes a splendid dark brown in three minutes, changes to green in four and a half, to golden yellow in six and a half, and to purple in eight and a half minutes. If the liquid be employed at another temperature than that given above, the appearance of the different colours will also vary in other short periods of time. If the zinc be left longer than eight and a half minutes in the copper liquid at 10° C., the last-mentioned purple colour disappears, being replaced by one or another of the preceding hues, depending on the time; but then they are never of the same brilliancy, and will continually diminish, until after some days' immersion the zinc is covered with a miscoloured suboxide of copper. For this reason the articles are removed from the bath as soon as the desired colour is fairly developed, and rinsed immediately in water. After careful drying, the metal may be coated with a good varnish to make the colours more durable.

Silvering and Gilding Zinc.—A direct silvering of zinc, according to Ebermayer, is not practicable, for although the zinc covers itself speedily and nicely with silver as well as with gold, yet this coating becomes dull and unseemly after a short time. The cause of this may be that the covering is too thin to perfectly cover the zinc. There is no other means left, therefore, but plating the metal first with brass or copper; it not being sufficient, however, to merely cover the zinc by simple immersion, it is necessary to produce a good durable precipitate, which may be accomplished by using the galvanic battery, and a solution containing cyanide of potassium. A process has of late been published in Germany to copper-plate zinc articles by simply suspending them on zinc wires in a solution of blue vitriol and caustic potash, which, to prevent a precipitate being thrown down, is mixed with tartaric acid or glycerine. Ebermayer further remarks that all articles made of sheet zinc are better adapted for plating with brass than castings, because the latter, if not most carefully handled, are liable to be disfigured with black spots.

Fine pulverized marble-dust mixed with dissolved isinglass makes a capital cement for marble objects.

Self-Illuminating Night Clocks.—A Parisian watchmaker has had the happy idea of applying one of the latest inventions in chemistry to the construction of night clocks. The dial of these clocks is prepared of a substance which has the property of absorbing daylight and to reflect it again when dark; so that the dial appears perfectly transparent, and the figures and hands may be seen at a yard's distance.

BRONZES.

By C. D. E. Fortnum, F.S.A.

BRONZE is an alloy of copper and tin in slightly varying proportions, with occasional but seemingly unimportant additions of silver, zinc, lead, and other simple metals. These last may be regarded as foreign to the true alloy rather than as necessary elements in its composition, although their presence may more or less influence its ductility and malleability. The normal composition of true bronze may be approximately fixed at nine portions of copper and one of tin; but the quantity of tin may be said to vary from eight to ten per cent. "Gun-metal" is of a similar composition.

This important alloy has been known and in use from a very early period, long before any written record of the world's history. We need not, therefore, delay to inquire into the mythical story that such a mixture of the metals was discovered by Idæan Dactyls, or first brought into use by the Telchines of Rhodes; nor need we, for our present purpose, do more than allude to the story of that Cadmus, of the Phœnician occupancy of Egypt under the seventeenth dynasty, who sailed to Greece, and by reason of the excellence of his weapons, formed of "Cadmian bronze," prevailed over his opponents and founded the Cadmian Thebes. In the Sacred Writings Tubal Cain is the earliest mentioned as an instructor of artificers in working brass (bronze) and iron. But whatever truth may be at the foundation of these and similar histories, we have the evidence of the objects themselves to prove the widespread and abundant use of bronze for the manufacture of weapons and tools, at a period so early as to be beyond any record, and which we can only now define as overlapping and succeeding the so-called "stone age." There can be little doubt the art was brought into northern and eastern Europe from Asia, and we may be equally assured that the composition of bronze was well known in Egypt, perhaps at a still more remote period. From thence its use may have spread to the European shores and islands of the Mediterranean, probably aided by, rather than originating with the Phœnician people. From those prehistoric times down to the present day the continuous use and value of bronze have been known: at first, in the production of weapons of war and for the chase—the improved successors of the celts and knives, spear-heads, scrapers and the like, of flint and stone; subsequently, for domestic and other utensils, and as a favourite and enduring material for the exercise of the sculptor's art. In our own day the use of bronze is comparatively less general than of old, for brass now arrogates the sway of the more costly and eternal bronze. Brass, less expensive and less noble than its sister alloy, is composed also of copper, but allied with the cheaper metal, zinc, which replaces the tin in larger quantities.

Without entering into a minute and scientific inquiry as to the nature and technical modes of production and manufacture of these alloys of copper with tin, zinc, and other metals, it may be well to take a rapid view of their history, composition, and application.

To begin with the parent metal, copper. It is probable that long before any systematic mode of reduction or combination with other metals was known to the early inhabitants of various countries in which the mineral occurs, pure copper, or rather the metal found in its native state, was, by partial fusion and by hammering, or other simple means, fashioned into weapons and other objects for use in such districts as yielded this valuable material ready to hand. We may reasonably assume that the use of copper in its native and unalloyed condition would have preceded the knowledge of its alloys with other metals; afterwards, the consequent modification of its properties, its very great ductility and malleability, together with the difficulty of fusion—qualities which render copper of the first importance for certain manufacturing purposes—would detract from its value as a material for the formation of weapons by a primitive people. Not that the use of unalloyed copper has ever ceased, but its value is in a different direction. The malleability which renders it too soft for weapons is peculiarly valuable in the formation of vessels of every variety of form, an use to which it has been applied in almost every age, and in none more so than in our own, when the requirements of chemical and other manufactures are met by the construction of enormous stills and refrigerating worms, boilers, and evaporating pans of this metal. Acres of sheet copper protect our ships from the attacks of various marine creatures; and, again, in the production of the crowd of smaller objects, such as our tea-urns, stew-pans, kettles, and the like, vast quantities of copper are consumed.

It is worthy of observation that, from the evidence afforded by the buried remains of their civilisation, bronze seems to have been used by preference in the production of culinary and other vessels for domestic use, even of large size, and copper in its purer state but rarely, during the flourishing periods of Egypt, Assyria, Greece, Etruria, and Rome. Not so however, during the "Gothic" period of the twelfth, thirteenth, fourteenth, and fifteenth centuries, when bronze and bell-metal, as well as "latten" or "electrum," were not less well known; for the majority of the admirably wrought objects for church use, such as reliquaries, chasses, monstrances, and mountings of heavy choir-books, etc., were of nearly pure copper, and heavily gilded with equally pure gold. So, again, during the Renaissance and subsequent period of decline, copper in beaten work (*repoussé*) was much used for vessels, many of which are of highly artistic form and ornamentation; as also for works of sculpture in *basso* and *alto relievo*, and for the formation of figures in a solid core; for example, the great statue of St. Carlo Borromeo, which overlooks the Lago Maggiore. Also, we must not forget the use of copper for coinage, and the production of medals struck in a die; nor its hitherto extensive use in the manufacture of copper plates for engraving.

The electro deposit, that ingeniously varied application of what, in our own memory, used to be merely a curious and striking demonstration of chemical or rather of voltaic action in the lecture room, has now developed into various extensive branches of manufacture, and is of the greatest value in the reproduction of artistic objects in an enduring material. In England this method has been applied with singular success by the Messrs. Elkington, the late Signor Franchi, and by many able French and German manufacturers in their respective countries. An important series of reproductions in metal by this process is collected in the South Kensington Museum, among which we may particularly note the celebrated gates of the baptistery at Florence, by Lorenzo Ghiberti—a remarkable work, of the exact size of the original. The Pisan gate, of bronze, is in the same museum, and many other interesting works of smaller size, described in detail in an official catalogue.

Copper occurs in its native state in amorphous masses of considerable size, and in crystalline laminæ permeating the fissures of quartz veins. It is also found in combination with other substances, constituting the ores from which the larger supply of the metal is obtained. These ores are more or less abundantly distributed in almost every country of the Old and New World. The island of Cyprus seems to have been one of the earliest sources known to the ancient classic writers, but perhaps the neighbourhood of Chalcis, in Eubœa, may have as old a claim. The mines of Spain, of Gaul, and of Anglesey, and probably those of Cornwall, were also known to the ancients, as was the existence of this metal in Tuscany and the south of Italy, in the Alps, and in Egypt, and various parts of Asia. Pliny, from whom (as might be expected) we derive the greatest amount of information on the subject, tells us that three of the ores of copper (*lapides ærosi*) were known to him, namely, the *cadmia*, the *chalcetis*, and the *aurichalcum* or *orichalcum.* How these varieties agree or correspond with the ores distinguished by mineralogists of the present day, it is hardly within our province now to inquire; nor can we do more than touch upon the large subject of their reduction into the metallic state. It has been argued, not without some probability, that the last of the ores mentioned by Pliny, and from which the golden-coloured Corinthian bronze is said to have been produced, may have contained a larger or smaller quantity of calamine, or perhaps of the sulphuret of zinc ("black jack"), which gave a yellow or brassy colour to the metal—a portion, in fact, of true brass.

(*To be continued.*)

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from page* 25.)

WHITE, in his "Fragments of Italy and the Rhineland," 1841, tells us that "at a certain period of every year namely, on the Feast of the Ascension, and fourteen days afterwards, the great clock tower of St. Mark's, which by the way is an edifice boasting a barbaric confusion of ornament that rivals any of its fellows in that Noah's ark of architecture, exhibits a curious piece of mechanism. On the summit of the Orologio is a great iron bell, forming a kind of cupola to the gateway, and heaving its black form against the bare sky. On each side stands a savage man of Ind, grasping an iron mace, with which he beats the hour upon the bell. On a platform midway in the building, and just over the huge gold and blue enamelled disc of the dial, is a balcony of gilt lattice, surrounding an image of the blessed Virgin and Child, who is seated between two doors all overlaid with gold. Whenever the clock strikes, the door on her right hand opens, and an angel with a trumpet in his hand steps out; he acts as a gentleman usher to the three Royal Magi, who pass before her, just as you might do before Queen Victoria at a levée, only that, instead of kissing hands, each raises his diadem or turban from his brow, makes a graceful obeisance, and in stately procession re-enters the turret by the other door. The figures are apparently as large as life, and gorgeously apparelled; and it really is a pretty pageant."

A street in Venice is named after this Orologio—a kind of nomenclature of which we have another example at Rouen, where the Rue de la Grosse Horloge, or the street of the great clock, is so called from a huge, clumsy, antiquated clock that is attached to the upper part of an arch across the street.

At Vicenza, in the Piazza de' Signori, which is a minified copy of the Piazza San Marco at Venice, is a small Torre dell' Orologio, or clock-tower, somewhat after the style of the one at the latter city above described.

The Gentleman's Magazine for 1799 informs us of the death at Green Street, on March 24th in that year, of Mrs. Forester, aged eighty-three, the widow of the then late Rev. Dr. F. Moore, and the daughter of the Hon. and Rev. Dr. Moore. This lady possessed at Great Brickhill, Bucks, the identical clock which was at Whitehall at the time of the execution of Charles I., in the year 1649, and by which the fatal moment was regulated. The effects of Mrs. Forester were shortly after her death dispersed by public sale.

The Philadelphia Library claims possession of the oldest clock in America; it is about two centuries old. It was made in London, keeps good time, and is said to have been once owned by Oliver Cromwell.

Charles II., according to tradition, gave to Mrs. Jane Lane a clock in memory of her services after the battle of Worcester. On the clock was engraved the name of "Henricus Jones, Londini." In "North's Life" it is stated that barometers were first made and sold by one Jones, a noted clockmaker, in the Inner Temple Gate, at the instance of the Lord Keeper Guildford. Probably Jones was the first Englishman who constructed a Torricellian tube, as the barometer was originally called, after its inventor, Evangelista Torricelli, who, between the years 1641 and 1647, discovered the means of ascertaining the weight of the atmosphere by a proportionate column of quicksilver.

In the museum of Kendal is an interesting specimen of a clock, which is said to be one of the first ever made on the pendulum principle. It stands on a bracket; it has one weight, suspended by a cord, and only one hand. It goes twelve hours, but by cutting away the floor beneath, it could be made to go twenty-four. The bell forms a dome over the clock; it has an excellent sound, and strikes all the hours. On each side of the case is a brass door. The clock still keeps correct time. On the dial is the following inscription—"J. C. George Pooll, in S. An's Lane, Fecit. The gift of James Cock, Maior of Kendall, 1654, to the Maior of the same, sucksesiuely. Time runneth; your work is before you." Old Humphrey wrote one of his "Pithy Papers" upon the subject of this clock and its motto, and has thereon hung a moral.

Evelyn, in his diary, has three curious entries respecting clocks. Under date February 24th, 1655, he says:—"I was shew'd a table clock whose ballence was onely a chrystall ball sliding in parallel wyers without being at all fixed, but rolling from stage to stage till, falling in a spring conceal'd from sight, it was throwne up to the utmost channel againe, made with an imperceptible declivity, in this continual vicissitude of motion prettily entertaining the eye every halfe minute, and the next halfe giving progress to the hand that shew'd the houre, and giving notice by a small bell, so as in 120 halfe minutes or periods of the bullet's falling in the ejaculatorie spring, the clock part struck. This very extraordinary piece (richly adorn'd) had been presented by some German Prince to our late King, and was now in possession of the Usurper, valu'd at £200." Under date November 1st, 1660, Evelyn says, "I went with some of my relations to Court, to shew them his Ma^ties^ cabinet and closset of rarities. . . . . Here I saw . . . . . amongst the clocks, one that shew'd the rising and setting of the Sun in ye Zodiag, the Sunn represented by a face and raies of gold, upon an azure skie, observing ye diurnal and annual motion, rising and setting behind a landscape of hills, the work of our famous Fremantel."

On August 9th, 1661, Evelyn says, "I din'd at Mr. Palmer's in Gray's Inn, whose curiosity excell'd in clocks and pendules, especially that had innumerable motions, and plaied 9 or 10 tunes on the bells very finely, some of them set in parts, which was very harmonious. It was wound up once in a quarter."

Pepys, in his diary, under date July 28th, 1660, records that he went "to Westminster, and there met Mr. Henson, who had formerly had the brase clock that went with bullets (which is now taken away from him by the King, it being his goods)." After the dates given by Evelyn and Pepys as above, it was not uncommon for clocks to be made with a small ball or bullet on an inclined plane, which dropped every minute. Gainsborough, the painter, had a brother who was a dissenting minister at Henley-on-Thames, and who possessed a strong genius for mechanics. He invented a clock of very peculiar construction, which after his death was deposited in the British Museum. It told the hour by a little bell, and was kept in motion by a leaden bullet, which dropped from a spiral reservoir at the top of the clock into a little ivory bucket. This was contrived so as to discharge it at the bottom, and by means of a counterweight it was carried up to the top of the clock, where it received another bullet, which in its turn was discharged like the former; this seems to have been one of the many attempts made at perpetual motion.

(*To be continued.*)

GOLDSMITH'S WORK OF THE ANCIENTS.

By the Author of "Antique Gems."

(*Continued from page* 19.)

Over the medallion of Christ is placed a large heart-shaped amethyst, below it an enormous rough sapphire; four more large sapphires are set at equal distances in the band, all but one being unpolished. The edges of the circlet are bordered with a row of pearls set close together. The large sapphire at the back is surrounded by four green stones, cut oblong; but their exact species has not been ascertained. In the deed by which Queen Elizabeth of Hungary pledged this crown to the Emperor Frederick IV., the stones are enumerated as being 53 sapphires, 50 rubies, one emerald, and 320 pearls. It is singular that the four green stones at the back are not entered in this list; perhaps they were known at the time to be only prases, and therefore not reckoned amongst the other stones of value. It will be remarked from the foregoing details that, although the Byzantine jewellers had still at their command abundance of sapphires, and of the finest quality, the true emerald had become very scarce. Yet, late under the Lower Empire, it was still profusely employed in the decoration of the imperial vestments, although ever accounted as next in value to the diamond. Claudian enumerates amongst the treasures left by Theodosius, under the guardianship of Stilicho—

> "Sidonian mantles rich with purple fold,
> Belts bossed with pearls, robes stiff with gems and gold,
> And breastplates shining green with emeralds bright,
> And helmets rich with precious sapphires dight."

In illustration of the last line, it may be remarked that his predecessor Constantine often figures upon his copper coinage in a helmet studded with gems set close together. This jewelled helm was the origin of the crown imperial in its present form, the gradual transition from the defensive to the decorative head-covering being easily traced upon the series descending to the Byzantine solidi. As to the excess to which this department of luxury, like all the rest, had been pushed by the Romans of more opulent times, a single anecdote of Pliny's will be a sufficient example (ix. 58):—

"I have myself seen Lollia Paulina (once the wife of the Emperor Caligula), though it was on no great occasion, nor she in her full dress of ceremony, but at an ordinary wedding-dinner—I have seen her entirely covered with emeralds and pearls strung alternately, glittering all over her head, hair, bandeau, ears, neck, necklaces, and fingers, the value of all which put together amounted to the sum of forty millions of sesterces (£400,000), a value she was ready to attest by producing the receipts."

This reminds us of Sedley's lines—

> "Such ropes of pearls her arms encumber,
> She scarce can deal the cards at ombre;
> Such loads of rings her fingers freight,
> They tremble with the mighty weight."

Pliny further states:—"Nor were these jewels the presents of a prodigal Emperor—they were regular family heirlooms—that is to say, bought with the plunder of provinces. This was the end gained by his peculations, this the object for which M. Lollius made himself infamous all over the East by taking bribes from its princes, and at last poisoned himself when C. Cæsar, Augustus' adopted son, formally renounced his friendship—all for this result, that his granddaughter might show herself off by lamplight, bedizened to the value of forty millions of sesterces. Let any one now count up on the one side the sums carried in triumph by a Curius or a Fabricius; let him picture to himself their scanty display of treasure; and on the other side, Lollia, a wretched female, a tyrant's plaything, seated at the feast; and would he not rather have seen them dragged down from the triumphal car, than to have conquered for an end like this?"

Among the other mad freaks of Heliogabalus was the serving-up dishes sauced with gold or precious stones; for example, peas with gold pieces, lentiles with rubies, beans with amber beads, rice with seed pearls (*albis*). The last he used, instead of pepper, with his fish and truffles. It will be observed that in the foregoing dishes there is a studied union of the most plebeian fare with the most precious objects of luxury.

A notice in Lamporidius (*sub* Maximis) gives us a curious peep into the trousseau of a Roman princess in the third century:—"Junia Fadilla, his betrothed bride, retained (after his murder) the imperial betrothal gifts, viz. a necklace of nine single pearls, a hair-net of eleven emeralds, a bracelet with clasp of four hyacinths." Her contemporary Tertullian exclaims, with his usual energetic extravagance, in his tractate "On Women's Behaviour," "The slight lobes of her ears outweigh a whole year's income, and her left hand squanders a money-bag on every one of its joints."

Caylus figures a necklace that gives a good notion of the style of Lollia's jewellery. It consists of fourteen short six-sided prisms of plasma, and six irregular pastes connected together by two gold links between each. The plasmas are one-third of an inch long, and very neatly cut. Amongst the finest specimens now extant comes, undoubtedly, the one formerly in the Uzielli Collection, composed of true love knots in gold, uniting large, irregular rubies and emeralds (fine stones), each perforated at the ends. Lucian makes the girl Corinna beg her mother to "buy her a gold necklace having in it some fiery stones, like that of Philimis." These people are of the lower class; the fiery stones, therefore, must have been common garnets, in which abundance of beads are found shaped exactly as the plasmas above mentioned.

REMARKABLE CLOCK MECHANISM.

In the French horological section at the Exhibition are two clocks remarkable for their mechanism. On the top of one of them is seated a handsomely attired Greek lady, a figure hardly a span high, with a small barrel-organ, supported by a boy, resting on her knees. With the last stroke of the clock this miniature organ is set in motion and plays a tune, the boy keeping time with his head. On the left arm of the figure is a bright starling, which, as soon as the piece is played out, repeats the melody, accompanied by the movements of the lady's head.

The mechanism of the second clock is still more wonderful. The clock is surmounted by a figure representing a juggler in Oriental costume, seated behind a golden table. To his right stand three large silver bells on a plate. The juggler raises himself as the clock strikes, and gesticulates with his hands as if in preparation for his feat, takes up one of the bells, shows it to the spectators to convince them that it is empty, then seizes another bell, and puts both on the table. He lifts them up again, and under each lies now a golden egg, which appears and disappears repeatedly. Sometimes both eggs disappear; sometimes they increase in number, and instead of two three or four eggs are seen. The little magician's performance reaches its climax when he turns up the third bell and displays a bronze ball to the astonished audience. This bronze ball bursts immediately after, and a Liliputian bird, about the length of a finger-nail, makes its exit and pipes a tune. The next moment all vanishes again, and the clever performer, after a graceful bow, resumes his seat.

It is reported that several large diamonds have lately been washed from the gravel at Myrtle Creek, Oregon.

AMERICAN WATCH MACHINERY.

THE *Times* of 22nd ultimo, in a descriptive article on "The American Mechanical Display at Paris," has the following regarding the exhibits of the Waltham Watch Company :—

"In the Waltham works science has been brought to the aid of native ingenuity to such a degree, that even since the Philadelphia Exhibition the fabrication of watches has gone through a large arc of another revolution. What was begun by applying such machines that their work was beyond competition on anything like equal terms from any hand work is continued by the construction of the most essential parts of the watch on a new principle, which permits an approach to perfection unattainable by the old mechanism, however produced. Every one knows that the great difficulty in making chronometers has been the compensation for the effects of expansion and contraction due to change of temperature, but what is less well known is that this difficulty is due less to the balance, which by its construction with a bi-segmental rim (of brass and steel) may be perfectly corrected, than to the expansion of the balance or hair-spring, which, being immensely longer, causes five times the error caused by the expansion or contraction of the balance wheel alone. The two pieces must be considered as one, and the compensation effected in the wheel or rim must answer for the spring as well as for itself. The theoretical and insuperable difficulty in this compensation has always been that the error caused by the expansion and contraction of the spring was in a different ratio from that of the correcting expansion or contraction wheel, and the two quantities may be compared to curves with two radii, which could be brought together at two points, but not to coincide throughout, so that if the compensation at the extremes of temperature is correct, the mean must be in error and *vice versâ*. The old compensation was, speaking broadly, in brazing a band of brass on one of steel, a process both theoretically and mechanically erroneous, since the contraction and expansion can only go on with a certain tendency to disrupture of the elements and consequent inequality of the action. The new balance proceeds on an entirely different arrangement of the compensating metals. The rim, of plain steel, is cut nearly through, at the fixed extremities of the semi-circles, by several saw-tooth shaped notches, the number determined by experiment, and the brass is forced into these notches. The compensating weights are then put on at the other extremities of the semi-circles instead of being distributed along them empirically, and it is found possible in this arrangement so to distribute the compensation and compensating weights as to give at will a compensation for the mean temperature, either in excess of, or less than, the extremes, and, of course, to give a compensation which shall coincide throughout, which makes it theoretically possible to give absolute compensation for all temperatures at once. It is difficult to make this clear without diagrams showing the exact curves attained by experiment; but the nature of the result will be appreciated by those who know the mechanism of the balance. It is simply the theoretical elimination of all error from the compensated balance so far as temperature is concerned. Practically and mechanically there will always be some, due to the inherent imperfection of human workmanship; but it is believed that the mean error, and equally the manual adjustment required, will be reduced to one-third of that actually obtaining under the old form of balance. But to illustrate how involved are the various improvements in mechanism, it may be noted that the delicacy of construction of the new balance would only have been possible with the mechanism introduced by the Waltham Company, the precision of which may be judged from that of the micrometer last produced and shown at Paris, which measures the twenty-five-thousandth part of an inch, and even indicates that so largely that it might be divided under a lens readily into hundred-thousandths. A micrometer screw-gauge detects inequalities in the thread of a screw up to hundred-thousandths, and a screw made for the Government Scientific Commission to correct the measures has been constructed, in which the *maximum* of error in the thread is less than one ten-thousandth of an inch."

BOOK NOTICES.

Treatise on Modern Horology, in Theory and Practice. Translated from the French of Claudius Saunier by Messrs. Julian Tripplin and Edward Rigg, M.A.

We have had the pleasure of perusing Parts VII. and VIII. of this valuable work, and we feel sure that they will prove a perfect boon to every workshop; in fact, the more we see of the book, the more are we convinced of its vast usefulness, and of the benefits which the trade will undoubtedly derive from it. The author, after imparting a sound knowledge of the general laws of mechanics, has led us step by step through the theoretical details of watchwork, thus enabling the student to reason for himself, and to clearly comprehend the exhaustive practical details which follow. We do not hesitate to assert that any intelligent watchmaker, after a careful study of the matter now in hand, will be able to construct a *correctly proportioned* escapement with frictional rest for a watch of any given size, offering all the accuracy in time-keeping which an escapement of this class can secure. We are, however, not only taught how to construct a new escapement, but also the modes of repairing one, and this latter portion of instruction will probably be the most welcome to a large class of our horological population. The author is quite justified in saying, "To thoroughly repair a watch is an operation which requires *more knowledge* than, and quite as much skill as, is necessary for its manufacture on the large scale, especially at the present day, when the sub-division of labour is carried to such an extreme." This superior knowledge, essential to a conscientious watch-repairer, is amply supplied in the pages before us, and all the apprentice and improver have to do is to make an intelligent application of it to acquire also the necessary skill.

Those of our readers who have not yet availed themselves of the services of this competent instructor and assistant, we strongly advise to do so without delay.

Electric Stop-Motion. By W. H. Bailey. A Paper read before the Scientific and Mechanical Society.

Electricity has certainly become valuable in the service of man, and fresh applications of this power to our national industries are continually being made. We are glad to be able to record another success in this direction, the electric stop-motion, as applied to cotton machinery, the subject of the pamphlet before us. Although not strictly within our province, we shall make such extracts as are likely to prove instructive and interesting to our scientific readers.

QUERIES AND ANSWERS.

F. S. wishes to know how to obtain the length of a cylinder.

K. D.—If you forward name and address, we shall be most happy to give you the required information; we cannot take notice of anonymous communications.

L. E.—Thanks for suggestion. You will find an article on the subject in our next.

Erratum.—Page 18, read E. Japy instead of E. Tapy.

Prices Current for Gold and Silver.—Value Given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver, 4s. 6½d. to 4s. 9d. (variable according to quantity).

THE ELECTRIC STOP-MOTION.

By W. H. Bailey.

A Paper read before the Scientific and Mechanical Society.

DURING recent times scientific men have constantly been surprised and delighted at the various ingenious applications of electricity. It has become a mere commonplace to say that we are anxiously waiting for, and in daily expectation of receiving, information of the application of this wonderful force as a motive power that will rival steam. The coming man, who will be an electrician, we expect will place us in possession of this knowledge, and thus earn the gratitude of mankind.

I will not occupy your time this evening with the mere history of the application of electricity in its various forms of electro-magnetism and magneto-electricity, because the details must be familiar to the minds of most members of this society. We had scarcely recovered from the surprise at the work of Mr. Bell in connection with the telephone, before we received information of the fossilising, or bottling up, of human speech by the invention of the phonograph; and still further have we been compelled to admire the achievements of electricians when we have read the accounts of the largest induction coil ever produced, which was exhibited by Mr. Spottiswoode at the last meeting of the Society of Telegraph Engineers, producing flashes of artificial lightning a yard and a quarter long.

Feeling that a description of a novel application of the electric current, as adapted by Messrs. Howard and Bullough, of Accrington, to cotton machinery, would be of some interest to the members of this society, on my informing that firm of my views, they readily and handsomely consented to place at my disposal any information and models to illustrate a short paper which I have ventured to bring before you this evening; and I think you will agree with me that the machinery being placed at our disposal for inspection, as actually working in cotton mills, will considerably facilitate any explanation that I shall endeavour to give.

Many inventions have been introduced into cotton and other textile machinery, known as stop-motions. These have been designed to act in an automatic manner to stop the machine when, from some cause or other, it begins to perform its duty in an improper manner, important instances being in cotton machinery when yarns and slivers break. Most of the mechanical instruments (and I use the word mechanacal in contradistinction to electrical), in order to be very delicate, are of a necessity very fragile and liable to derangement. Messrs. Howard and Bullough claim that the stop-motion introduced by them is of very great delicacy, and almost absolutely without any moving parts of a fragile description, or which are liable to derangement. The fact that cotton, when in a comparatively dry state, is a non-conductor of electricity, is the leading principle of the method which has been taken advantage of and adopted for the electric stop-motion for the machines, which I am about to describe this evening. The machines comprise a carding-engine, a drawing-frame, and an intermediate or roving frame. The perfect adaptability of electricity for stopping purposes may probably be best seen and understood by an examination of the drawing-frame, for here no less than four conditions can occur in which the work can be spoilt, when in each case it becomes necessary to stop the machine. Firstly, a sliver may break on its way from the cans to the drawing rollers; this also includes a can getting empty; second, the cotton may lap or accumulate on the drawing rollers; third, the slivers may break in passing from the drawing rollers to the callender rollers, as, for instance, by lumps on them, and which cannot pass through the funnels above the latter rollers; and fourth, when the front cans get filled with the drawn sliver. Before we consider the application of each of these cases in the order given, I will, in general terms, describe the principle of the invention of Messrs. Bullough and Smalley. The electric current is supplied by a magneto-electric machine, which is driven by a small band or belt from the main driving-shaft. The machine weighs but a few pounds, and is driven by a belt an inch broad. The power absorbed by this machine is about as much as will drive a small sewing machine. In the early history of the invention the ordinary electric batteries were found to be unreliable, for reasons which will be obvious. The electricity being constant, of course it is always available so long as the engine is running. One pole is connected by means of a rod or wire to the machine frame, and the other pole to the electro-magnet, in as simple a manner as the ordinary wires conduct electricity to electric bells in a house; in fact it will be, I think, unnecessary for me to describe the mere alphabet of electricity, as you will understand the magneto-electric machine simply acts exactly as a battery acts to the ordinary electric bells; and instead of ringing a bell when contact is made, the electro-magnet at the machine attracts an armature of soft iron, which drops into a ratchet wheel, whose motion being impeded causes the strap to work upon the loose pulley, and thus stop the machine, electrical contact being made in each case of stoppage by the various simple contrivances which are attached to the machine, and which only act when an improper performance of duty takes place.

Carding Engine No. 1.

I will now proceed to describe the application of this system to a carding engine. The stop-motion acts automatically when attached to a carding engine by either the breaking of a sliver, or when the can becomes full. The breaking of the sliver causes the two small callender rollers inside the coiler to touch each other, producing electrical contact, and the machine stops. When the can becomes full, in an equally simple manner the tube wheel in the coiler becomes gently raised until it makes electrical contact, and then stops the machine. The stoppage of a carding engine, however, is disadvantageous on many grounds—it is generally preferred by spinners to incur a little "waste" rather than experience this evil. The current, therefore, in this case, instead of being the means of stopping the machine, is made to ring a bell as an alarm to the attendant that something requires his prompt attention. It may be well to state that the bell continues ringing until the evil is remedied.

(*To be continued.*)

Electro-metallurgy of Cobalt.—Mons. A. Gaiffe, the well-known electro-metallurgist, has been struck with the beauty of cobalt galvanically deposited, as well as by its hardness. It is not oxidised like iron, and much less care is required to keep its surface in good condition. Its beautiful white colour will make it suitable for the decoration of other metals. The bath used was a neutral solution of the double sulphate of ammonia and cobalt, which does not require nearly so much care as the nickel baths. The anode may be a sheet of platinum, or better a sheet of cobalt, either cast or forged. To obtain a white and adhesive deposit, the current ought to be regulated at the outset at six units of electro-motive force of the standard of the British Association, and be brought to three units only when the entire surface of the article to be coated has become white.

"Watch the dial's shadow moving;
Life and time are worth improving;
Seize the moments, while they stay;
Seize and use them,
Lest you lose them,
And lament the wasted day."

THE

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PATENTS.

Applications for Letters Patent.

3067. Max Tuteur, of Hatton Garden, in the county of Middlesex, Manufacturing Wholesale Jeweller, for an invention of "A new or improved fastening for lockets, watches, and other articles."—Dated 2nd August, 1878.

3071. Thomas Peter Hewitt, of Scotch Lane, Prescot, in the county of Lancaster, for an invention of "Improvements in the mode of and apparatus for cutting watch, clock, and other small wheels."—Dated 3rd August, 1878.

3082. Hermann Francis Jung, of 4, Charles Street, in the parish of St. James, Clerkenwell, in the county of Middlesex, Watchmaker, or an invention of "Improvements in watches and other timepieces."—Dated 3rd August, 1878.

3091. William Robert Lake, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, for an invention of "Improvements in watches and other timekeepers."—A communication to him from abroad by Victorien Bousset, of Morez-du-Jura, Jura, France.—Dated 3rd August, 1878.

3105. Pierre Auguste Baron, Merchant, of Boulevard de Strasbourg, 23, Paris (France), for an invention of "An improved bracelet."—Dated 6th August, 1878.

3132. Frank Walter Hayward, of the city of Norwich, Chronometer and Watchmaker, for an invention of "Improvements in watches for pocket timekeepers."—Dated 8th August, 1878.

3176. Frank Wirth, of the firm of Wirth and Company, Patent Solicitors, at Frankfort-on-the-Maine, in the empire of Germany, for an invention of "Improvements in clasps for necklaces and the like articles."—A communication from Heinrich Hopff and Carl Hopff, persons trading under the firm Gebrüder Hopff, at Hanau-on-the-Maine, in the empire of Germany.—Dated 12th August, 1878.

3200. Richard Henry Jones, of Birmingham, in the county of Warwick, Goldsmith and Jeweller, for an invention of "Improvements in ornamenting articles of jewellery, bracelets, scarf rings, and other dress ornaments and fastenings."—Dated 13th August, 1878.

3271. Friedrich Hermann Felix Engel, Civil Engineer and Patent Agent, in the city of Hamburg, Germany, for an invention of "Improvements in stud fastening."—A communication to him from Otto Rafflenbeul and A. Kähl, both of Hamburg, in the German empire.—Dated 19th August, 1878.

3316. Jean Tetzis, Professor, of Galatz (Greece), for an invention of "Improvements in clocks, watches, and other timekeepers."—Dated 22nd August, 1878.

Grants of Provisional Protection for Six Months.

2899. Joseph Needham, of Wilton Place, Knightsbridge, in the county of Middlesex, for the invention of "Improvements in the construction of sleeve links, solitaires, and collar and other studs and fasteners."

2993. Alexander Melville Clark, of Chancery Lane, in the county of Middlesex, Patent Agent, for the invention of "An improvement in the dials and scales of watches, clocks, barometers, thermometers, and other instruments."

2924. Thomas Mills, of Oldham, in the county of Lancaster, for the invention of "Improvements in watches."

3067. Max Tuteur, of Hatton Garden, in the county of Middlesex, Manufacturing Wholesale Jeweller, for the invention of "A new or improved fastening for lockets, watches, bags, and other articles."

3071. Thomas Peter Hewitt, of Scotch Lane, Prescot, in the county of Lancaster, for the invention of "Improvements in the mode of and apparatus for cutting watch, clock, and other small wheels."

3082. Hermann Francis Jung, of 4, Charles Street, in the parish of St. James, Clerkenwell, in the county of Middlesex, Watchmaker, for the invention of "Improvements in watches and other timepieces."

3132. Frank Walter Hayward, of the city of Norwich, Chronometer and Watchmaker, for the invention of "Improvements in watches or pocket timekeepers."

Patent Sealed.

686. Elijah Atkins, of Birmingham, in the county of Warwick, Manufacturer, for an invention of "Improvements in fastenings for solitaires, sleeve links, and other like articles."—Dated 19th February, 1878.

Notice to Proceed.

1664. Walter Henry Collins, of Great King Street, Birmingham, Manufacturing Jeweller, has given the like notice in respect of the invention of "Improvements in the manufacture of solitaires, studs, and other similar articles."

Patents Granted in Foreign States.

GERMAN EMPIRE.

1860. Winterhalder & Hofmeier, of Schwärzenbach, for "An alarum for eight-day clocks."—Dated 7th September, 1877.—Class 83.

1903. A. V. Lohr, of Vienna, for "An apparatus for the automatic winding of clock-work exposed to concussions."—Dated 10th January, 1878.—Class 83.

1912. R. Glaser, of Dresden, for "A process for moulding golden and silver rings, thin plate, and fine wire."—Dated 25th January, 1878.—Class 31.

1937. The Clockwork Company, of Lenzkirch, Baden, for "A support for clock-work and appliance for the suspension of the pendulum."—Dated 9th February, 1878.—Class 83.

1989. Fr. C. F. Schlesicky-Stroehlein, of Frankfort-on-the-Maine, for "A spectacle-holder."—Dated 16th December, 1877.—Class 42.

1998. A. Th. Goll and C. A. Schlund, of Frankfort-on-the-Maine, for "A wrist-stud and squeezer."—Dated 12th January, 1878.—Class 44.

2030. Japy, Brothers, and Co., of Paris, for "Improvements in watchwork."—Dated 17th October, 1877.—Class 83.—Addition to Patent No. 1866.

2046. Ch. Riballier, of Paris, for "A process for decolouring diamonds."—Dated 25th November, 1877.—Class 1.

2092. K. Fritsch and J. Forster, of Vienna, for "A telescope."—Dated 27th November, 1877.—Class 42.

UNITED STATES OF AMERICA.

201,600. P. S. Eddy and Oliver P. Coggeshall, of Providence, R.I., for "Collar and sleeve buttons and studs."—Application filed 26th December, 1877.

201,623. Peter F. Nilson, of Santa Rosa, Cal., for "Watch-case springs."—Application filed 5th February, 1878.

202,012. Frederic Fitt, of Ottawa, Ontario, Canada, for "Watch going-barrels."—Application filed 23rd November, 1877.

202,041. Chas. H. Meylan, of New York, N.Y., for "Chronograph-watches."—Application filed 7th December, 1877.

202,095. Henry J. Davies, of Brooklyn, N.Y., for "Clock-cases."—Application filed 17th January, 1877.

202,275. Henry W. Ley, of London, England, for "Clocks."—Application filed 1st October, 1877.

202,344. Wm. Haines, of Philadelphia, Pa., for "Adjustable watch-keys."—Application filed 31st January, 1878.

202,588. William Riker, of Newark, N.J., for "Finger-rings."—Application filed 2nd March, 1878.

202,597. Gilbert Sisson, of Providence, R.I., for "Swages for forming jewellers' dies."—Application filed 4th October, 1877.

202,795. Henry J. Davies and Walter D. Davies, of Brooklyn, N.Y., for "Clocks."—Application filed 5th March, 1878.

202,838. Jos. E. Lavey, of Huntington county, Ind., for "Watchmakers' lathe-chucks."—Application filed 29th June, 1877.

203,040. Heinrich Henrich, of New York, N.Y., assignor to Rosa Henrich, of the same place, for "Dies for forming settings for lockets."—Application filed 19th March, 1878.

203,046. Thomas A. Hopkins, of Providence, R.I., for "Centre rims for watch-cases."—Application filed 11th June, 1877.

203,106. Henry Berry, of West Meriden, Conn., for "Jewel-caskets."—Application filed 9th February, 1878.

203,263. H. C. Grawe, of St. Louis, Mo., for "Pendulum adjustments for clocks."—Application filed 29th March, 1878.

203,323. Wm. B. Closson, of Boston, Mass., for "Finger-rings."—Application filed 27th November, 1877.

203,455. C. W. Hoehn, of Carlinville, Ill., for "Winding attachments for watches."—Application filed 13th April, 1878.

FRANCE.

121,979. Delion, for "Manufacturing celluloid clock and watch dials, manometers, barometers, &c."—Dated 8th January, 1878.—Class 12.

122,057. Ratel, for "Improvements in drills for watchmakers."—Dated 11th January, 1878.—Class 12.

122,089. De Loehr, for "An automatic contrivance for winding up watches liable to be shaken." Dated 11th January, 1878.—Class 12.

122,097. Bizeul, of Dax, for "A counter-pressure parachute for the clock-trade."—Dated 22nd January, 1878.—Class 12.

122,101. Fortou, for "Jewel-cases."—Dated 15th January, 1878.—Class 17.

Designs Protected in Foreign States.

UNITED STATES OF AMERICA.

10,625. George Ager, of Thomaston, Conn., assignor to the Seth Thomas Clock Company, of New York, N.Y., for "A clock-face."—Application filed 5th March, 1878.—Term of patent 14 years.

10,627. George Hoyting, of Thomaston, Conn, assignor to the Seth Thomas Clock Company, of New York, N.Y., for "A pendulum-weight."—Application filed 5th March, 1878.—Term of patent 7 years.

10,628. Merwin C. Jones, of Thomaston, Conn., assignor to the Seth Thomas Clock Company, of New York, N.Y., for "A clock-case."—Application filed 5th March, 1878.—Term of patent 7 years.

10,642. John A. Hedstrom, of New York, N.Y., for "A bracelet."—Application filed 25th March, 1878.—Term of patent 3½ years.

10,645. Henry Griffith, of Brooklyn, N.Y., for "A scarf-pin."—Application filed 5th April, 1878.—Term of patent 3½ years.

10,648. Abraham Steinau, jun., of Cincinnati, Ohio, for "A set of jewelry."—Application filed 27th March, 1878.—Term of patent 7 years.

10,650. William A. L. Miller, of San Francisco, Cal., for "Cabinet jewelry."—Application filed 6th November, 1877. Term of patent 7 years.

10,651. Ernst H. Zoepfel, of New York, N.Y., for "A jewel-case."—Application filed 4th April, 1878.—Term of patent 7 years.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Jones, Lewis David, Crown Inn, Brynaman, Glamorganshire, innkeeper and watchmaker. July 31. T. G. Williams, sol., Llandilo.

White, Chas. Towyn, Merionethshire, jeweller. Aug. 5. Town-hall, Aberystwith. J. H. Ravenhill, sol., Aberystwith.

Sweetman, Jas. Windrow, Derby-road, Kirkdale, Liverpool, jeweller. Aug. 7. M. Browne, sol., 57a, Dale-street, Liverpool.

Davis, Frank Isaac, Warstone-lane, Birmingham, jewellers' factor. Aug. 16. Webster and Graham, sols., Colemore-row, Birmingham.

Harris, Fredk. Harvey Barr, 27, Claremont-square, goldsmith and jeweller. Aug. 14. Spyer and Son, sols., 1, Winchester House, Old Broad-street.

Palmer, Cornelius Stocker, 82, Bishop's-road, Paddington, jeweller. Aug. 16. C. Fitch, sol., 5, Featherstone-buildings, Holborn.

Windel, Conrad, Market-street, Bradford, watchmaker and jeweller. Aug. 12. Taylor, Jeffery, and Little, sols., Bradford.

Greenwood, Henry, 17, Hanway-street, Oxford-street, jeweller. Aug. 30. At Inns of Court Hotel, Holborn, Sept. 9, at 2. W. E. Ruddle, sol., 4, Orchard-street, Portman-square.

Service, John, 23, King Cross-street, Halifax, watchmaker. Aug. 21. C. H. Leeming, sol., Halifax.

Ware, Alfred, Oxford-street, Kidderminster, jeweller. Aug. 23. Roden and Dawes, sols., Kidderminster, Sept. 10, at 2.

Trustees Appointed.

Furneaux, Wm. S. (Liq.), Tottenham-court-road, fancy jeweller. Tr., L. Hasluck, 5, Jeffrey's-square, St. Mary Axe, accountant.

Billyeald, Alfred (Liq.), Angel-row, Nottingham, jeweller. T. Leman, Nottingham, accountant.

Harris, Alfd. (Liq.), Rhyl, Flints, jeweller. Tr., W. L. Harrison, 37, Cannon-street, Birmingham, accountant.

Nelson, Horatio W. (Liq.), 377, City-road, jeweller. Tr., W. H. Pannell, 1, Guildhall-chambers, Basinghall-street, accountant.

Vuilleumier, Jean C. P. (Liq.), 22, Welbeck-street, Cavendish-square, watch manufacturer. Tr., F. B. Leeming, 10, Coleman-st., acct.

Hughes, Joseph (Liq.), Minories, optician. Tr., J. Smart, 118, Cannon-street, accountant.

Foden, Edwd. R. (Liq.), Whittle-street and Great Ancoats-street, both Manchester, watchmaker. Claims by Sept. 1 to S. B. Kendal, Peter-street, Manchester, accountant.

Adjudications of Bankruptcy.

Smith, S. B., trading as S. B. Smith and Co., Penn's-lane, Chester-road, Warwickshire, electro-plater and gilder. Aug. 2.

Dividends.

Campbell, Andrew, jun., Newington-causeway, jeweller. First and final dividend 4d. J. Andrews, 8, Ironmonger-lane.

Dissolutions of Partnerships.

Gabriel, P. and Co., Manchester-street, Liverpool, watchmakers, jewellers, and opticians. Aug. 1.

Tripp and Bossom, Percy-street, Tottenham-court-road, jewellers. July 23. Debts by Wallace J. Tripp.

Naylor and Norton, 14, Kensington-road, Bradford, watchmakers. July 27.

Grindon and Baker, High-street, Bow, jewellers. July 31.

Lecomber, Jno. and Co., Slater-street, Liverpool, watch manufacturers, Aug. 3. Debts by John Lecomber.

Barnet, Abraham and Son, Hull, jewellers, &c. Nov. 6, 1876. Debts by Barney Barnett.

Allgemeines Journal der Uhrmacherkunst.

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DEPOSITS ON WATCH WORK.

A CORRESPONDENT of the *Deutsche Uhrmacher Zeitung* calls attention to the injudicious practice of blowing dust off of watchwork. He says that the operation looks so harmless that but few ever think of the destructive consequences attendant on the contact of humid breath with polished steel surfaces and springs. At lower temperatures a kind of veil covers the parts at once after blowing, which gradually disappears again, but it is in fact nothing else than a watery deposit, or steam reduced to water. Generally the deposit evaporates as the object gets warmer, but this is not *always* the case. Many watchmakers must have observed that polished steel surfaces are sometimes dotted over, apparently with particles of dust, which on closer examination are found to be rust. Perhaps many have been puzzled to account for rust spots between the coils of a spring, very minute, but still sufficient to render the article useless. These serious defects, says our authority, may in most cases be put down to the evil influence of warm breath, microscopic particles of water, for want of sufficient heat to evaporate, having remained on the surfaces and done the mischief described.

FLYING JEWELLERS.

THE *Globe* says :—For many years there has flourished in the Metropolis a gang of swindlers known by the appellation of "flying jewellers." They travel from place to place, imposing on the public by inserting in the daily papers advertisements for the purpose of borrowing money at short dates, returnable with promised handsome *douceurs*. They profess to be diamond merchants and wholesale jewellers, carrying on business in London and other cities. They visit large towns in England and Scotland, particularly Edinburgh and Glasgow. The loan they require is generally for a short period, perhaps one or two months, sometimes only fourteen days. They produce pawnbrokers' tickets from London for articles of jewellery. These they offer to lenders by way of security, quite keeping out of sight that the market value has already been fully realised. As security the tickets were consequently worthless, although these people represent them as being worth three or four times the amount the pawnbroker had lent on them. They prefer to trade with these tickets alone, but should this not be practicable, through their having met with an individual who possibly knows something, they offer a tangible security of fictitious value, seeing that it consists of gaudy manufactured goods, to entrap the unwary. With this kind of sham security they give their own bill for the sum lent and the interest payable at the proposed period of the loan. The articles, tickets, bills or notes are delivered to the lender, sealed up, to remain in his custody till the maturity of the bill or promissory note, on payment of which the packet is to be returned to the borrower. By these fraudulent means many persons have been induced by the temptation of high interest, and the possession of apparently valuable jewellery, to lend their money, and so be defrauded of it. It is needless to add that when the bills become due they are never honoured, and the parties are not then to be heard of. Surely such a class of swindling as this presents a fine field for the newly appointed Criminal Investigator and his subordinates.

WANTED.—FOREMAN in a Watch Factory; must thoroughly understand the escapement, and have had good experience. In first place apply by letter to A. M. J., care of Mr. J. Walton, 7, Upper Charles Street, Clerkenwell.

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HOROLOGY.

(*Continued from page* 30.)

XXXVII.—The Pendulum.

It is still a question of some doubt as to who was the exact individual that first conceived the idea to measure time by the oscillations of a pendulum. The Italians claim the honour for one of their countrymen, but there are records to show that long before the days of Galileo the ancient Asiatic astronomers measured the duration of transits and eclipses by counting the vibrations of a pendulum; and to show that this was practicable, we notice that in modern times European and American astronomers have used pendulums in this manner for certain temporary operations in the field.

Galileo was the first who formally announced, in his work on mechanics and motion, which was published in the year 1639, the isochronal property of oscillating bodies suspended by strings of the same length; and it has been said that he actually applied a pendulum to a clock, for the purpose of observing eclipses and determining longitudes; but as there is no proof existing to corroborate the assertion, the fact may be considered doubtful. Sanctorius, in his *Commentary on Avicenna*, describes an instrument to which he had applied a pendulum in 1612. Richard Harris is said to have constructed, in 1641, a pendulum clock in London for St. Paul's Church, Covent Garden. Vincenzo Galilei, a son of Galileo, is stated, on the authority of the *Academy del Cimento*, to have applied the pendulum in 1649. It was applied by Huyghens in 1656, and by Hooke, for whom the invention has been claimed, about 1670. But to whomsoever the merit may belong of having first made the application, Huyghens is unquestionably the first that, in his *Horologium Oscillatoreum*, explained the theory of the pendulum; and in this account, perhaps, the invention of the pendulum clock has been usually ascribed to him. After demonstrating the true theory of the pendulum, Huyghens' next object was to devise a means of causing a pendulum to vibrate in such a manner that its centre of oscillation would describe the arc of a cycloid. Many of our readers will have noticed old clocks, mostly in buhl cases and of French construction, having the verge and crown wheel escapement, and a very light pendulum suspended from a thread, on each side of which thread are placed two pieces of curved brass, which represent part of the evolute of a cycloid. As the pendulum moves, the thread touches the brass curves and raises the ball—or, in fact, it raises the whole of the pendulum up, and approximately causes the centre of oscillation to describe a cycloid. This was the plan by which Huyghens sought to obviate one of the irregularities in clocks having large vibrations; still, the varying impulse the pendulum receives in its descent, imparted to it from the crown wheel through the verge, and the variation of resistance it has to encounter from the recoil of the crown wheel on its ascent, makes the cycloidal curve of no practical use could it be carried out, and it is now abandoned by all men of experience.

The pendulums of all clocks of modern construction do not vibrate in an arc large enough to show any perceptible difference between the circular and cycloidal curve; yet we sometimes meet with a certain class of tradesmen whose knowledge of their business amounts to nothing more than a foggy superstition, and who are possessed of many secrets they carefully treasure up, who pretend to adjust a pendulum and make it isochronal by manipulating the pendulum spring, or causing it to work between two curves of a peculiar shape, and which is nothing more than attempting to put in practice what Huyghens abandoned 200 years ago; and Huyghens himself shows that the error of the hundredth of an inch in the form of the cycloidal curve described by the pendulum ball causes greater irregularity than if the pendulum described an arc of 10° or 12° on each side of the point of rest, in a circle. In modern clockwork the maximum vibration of a pendulum need not be more than a degree and a half or two degrees each side of the point of rest; and in that arc there is no difference between the cycloidal and circular curve that, in practice, makes itself visible by affecting the isochronal properties of a pendulum. Consequently, the pendulum may as well be allowed to swing in a circle as to endeavour to make it swing in a cycloid. If we take any fine clock that is constructed on the common principle of maintaining the vibrations of the pendulum *directly* from the weight, and increase or diminish the weight, the length of the vibrations will be diminished or increased accordingly, and the rate of the clock will be affected according to the kind of escapement it may have. In the dead beat, or Graham escapement, any increase in the vibration of the pendulum has a tendency to make the clock go slow; this change of rate does, however, not occur because the pendulum is not describing a cycloid, but because it makes larger vibrations, the pallets have a corresponding increase of friction by having to travel farther on the teeth of the escape-wheel, and hence the vibrations of the pendulum are slower. If the error in the rate of the clock had its origin in the pendulum describing a circular curve instead of a cycloidal, it is remarkable that under the same circumstances a clock with a recoiling escapement goes very much faster as the vibrations increase. Almost any one who is not already aware of the fact has an opportunity of satisfying himself by direct experiment of the different effects of increasing the weight of a clock with a dead beat escapement and one with a recoiling one.

Clock pendulums are usually constructed with bobs of lenticular shape, or shaped like a lens, or a disc—thick in the centre, and tapering towards the edge—and is adopted principally with a view of taking up as little room as possible in the thickness of the case. It is a mistake to suppose that this form is the best one adapted to obviate the effects of the resistance of the air in the motion of the pendulum. The solid content of a simple sphere, or round ball, is greater than any other-shaped body of equal size; consequently, a bob of this shape is less affected by the resistance of the atmosphere, because it contains a greater amount of weight in a smaller space, and presents less actual surface exposed to the air than any other form that can be devised. It, however, occupies greater amount of space in the thickness of a clock case than can often be spared; still there are many instances in which it might be adopted oftener, especially when utility does not require to be sacrificed for the sake of appearance. In turret clocks there is no reason why a spherical-shaped pendulum bob should not always be used; they are as cheaply made as those of a lenticular or cylindrical pattern, and the pendulums are more steady in their vibrations, and less liable to be affected by currents of air, than those having bobs of any other pattern. Some may think that for the purpose of very fine clocks these bobs do not afford the same facilities for compensation as bobs of other forms do; but when we come to consider the subject of compensation, we will describe a method by which they are compensated with the greatest nicety. Lead is the best metal for pendulum balls of all shapes, and should always be the principal one used in their construction when it is practicable. It occupies less space than any other metal available, and is not influenced by magnetism as iron is. It is a most important consideration in the making of bobs that care be taken to have the holes that pass through them exactly in the centre of the mass. In constructing the rod, no more metal should be used than is just necessary to make it stiff enough not to bend or yield by the vibration of the ball, and it ought also to be shaped with a view of attaining the same object—stiffness and lightness.

Wood is probably the best material that can be employed for the rod of a cheap pendulum, as it varies but little in length, and therefore does not require compensation. Some attribute the general good performance of wood pendulums partly to the lightness of the rod. Any wood is suitable for this purpose that has a fine straight grain. The wood ought to be split up, like laths, to nearly the size required, and when fitted ought to extend the whole length of the pendulum, from the suspension spring to the regulating screw, and should be carefully protected from decay by varnish coated over several times, taking special care to have any end wood that may be exposed thoroughly saturated with varnish, to protect the wood from the influence of damp.

In constructing pendulums, generally, there is not that care taken with some of the important points that ought to be. It is usually the last thing that is made about a clock, and on that account the workmanship is often hurried. It is also becoming too common to consider the pendulum only as a showy appendage to the clock, whereas the fact is that the clock is but an appendage to the pendulum. So far, indeed, are the wheels, or any other part of the movement, from contributing to the time of the pendulum, they are mostly found to disturb it. In constructing a pendulum, whether it be a plain or a compound one, it ought to be a point of prime consideration with the artist to have all the weight that constitutes the pendulum as much as possible concentrated in the ball. A pendulum is a body revolving about a fixed point or axis, and there are points in it subject to the same rules as other bodies in mechanics that revolve about a fixed axis. In the imaginary pendulum the centre of gravitation, centre of gyration, and centre of oscillation are all at the one point; but in the real or material pendulum they occupy different points, according to the form of the pendulum, and the weight of its rod in proportion to the weight of the ball. We shall proceed in our next to consider these several points briefly, and give rules by which they may be found.

(To be continued.)

A TURRET-CLOCK is being provided for the parish church, Pollokshields. It has four illuminated dials, each 7 ft. 2 in. in diameter, the dials, it is said, being larger than those of any other turret-clock in Scotland. The clock will strike the hours on a bell weighing 24 cwt. All the wheels are made of the finest gun-metal. The main wheels are 18 in. in diameter, and 1½ in. in thickness. The escapement is "Graham's dead-beat," with wooden rod pendulum 14 ft. long, the ball of which weighs 1½ cwt. The striking-weight of the clock weighs 5 cwt., the gong 1½ cwt. The clock is fitted with a self-acting lighting machine for illuminating the dials. Messrs. H. & R. Millar, of Edinburgh, are the makers.

JEWELLERY.

By George Wallis.

(*Continued from page* 31.)

ROMAN jewellery, like Roman art generally, is little more than a reflex of Greek. In short, there can be little doubt that it was for the most part the production of Greeks, working in a less refined spirit. The Roman conquered, or purchased, the means of luxury and refinement, and the Greek was ready to administer to both. At a late period Egyptian and Asiatic forms found their way into Roman jewellery. Rings were largely used upon the fingers, a fashion said to have been derived from the Etruscans, and from the size and character of some of these which have come down to modern times, they were probably marks of official authority. There are amongst the rings acquired in the Waterton Collection, now in the South Kensington Museum, some of the time of Pliny, which are decorated with open work, being pierced through at the sides of the bezel and the shoulder, whilst occasionally the whole ring is perforated.

The next distinct style of manufacture, passing over the Byzantine period as one of transition, is that known as the Merovingian of the fifth century, and the Anglo-Saxon, of later date. With them may be associated the Celtic, all finally leading to the mediæval jewellery popularly known as the Gothic. We have orientalism running through all these, of a character more or less marked, but ever modified by the peculiar spirit of each age, yet ever preserving the traditions of the goldsmith's art in the application of details and the adaptation of forms to use.

The Merovingian and Anglo-Saxon character of construction and decoration is best illustrated by ornaments, in which thin slabs of garnet are set upon films of diapered gold. The slabs are divided, and held in position by thin walls of gold, soldered vertically as in cloisonné enamel, some of the Anglo-Saxon examples being decorated with elaborate filagree work, executed with marvellous accuracy and skill as regards detail. The beaded work, and cords of twisted gold brought into play by means of the intricate convolutions of their details, is ever a subject of interest to the antiquary and the intelligent jeweller, not only from the *finesse* which characterises the execution of the work, but for the exquisite and appropriate character of the design, which never seems to fail or exhaust itself.

The Celtic hammered work in plates of gold, of various sizes, forms, and adaptations to uses now unknown, are evidences of another kind of skill. The ornamental details are in repoussé; vitreous pastes, amber, and rock crystal having a perfectly smooth, rounded surface, or, speaking technically, cut "*en cabochon*," are also used as decorative adjuncts. Filigree and plaited work, and delicately overlaid wire ornaments, also characterised much of the Celtic jewellery, together with niello and enamel. The skill in execution and wonderful subtility of design found in some of these ornaments discovered in Ireland and Scotland cannot be excelled, but the oriental spirit manifested in some of the specimens is unmistakable.

Mediæval jewellery of the period from the tenth to the thirteenth century is rarely seen except in the form of rings. These are either of great simplicity or massiveness, and frequently of both. They show little tendency to elaboration in the way of ornamental details, or any departure from the essential form necessary to the object in relation to its use.

The sixteenth century, known as the period of the *cinque-cento*, brought as great a change in jewellery, and objects of personal decoration, as in any other division of the arts. Gothic art had expended itself, but had stamped its spirit on everything of use and decoration, whether civil, military or ecclesiastical. It had become fossilised, as it were, dead, and utterly contrary to the new condition of things which sprang up with the revival of learning in Europe. All its forms and traditions had to give way before the genius of the artists of the *cinque-cénto* period, men who were not handicraftsmen merely, but artists in the best sense of the word, when the jewellers' art culminated in the works of Albert Durer, Benvenuto Celleni, and Hans Holbein.

The Italian goldsmiths and jewellers of the *cinque-cento* have left such examples of their ability as will ever continue to influence in a greater or less degree all future workers in gold. The character of the design and workmanship, at once so rich in detail, yet so light and elaborate in the mass, the exquisite arrangement and introduction of the gems employed, the beauty of the enamel, whether opaque or translucent, and the perfect adaptation of the jewels to use in connection with the rich and elaborate costumes of the period, of which these jewels formed no inconsiderable portion, must ever leave the *cinque-cento* in the ascendant as regards its decorative character and the power displayed in its design and execution.

Of the seventeenth and eighteenth century works, very little need be said. The art became more or less mechanical, with the excellence of workmanship in the accurate manipulation of the metal, the elaborate cutting of the stones, the fitting of the parts together, so as to convey the idea of a finished article, but with very little regard to the special relation which the ornament was intended to bear to, or the part it was to play in, the costume of the period. Gorgeous in the abstract, the clustered diamonds were often brought together rather for the purpose of combining a given value in some settled form than for the purpose of utilising the beauty of the stones for the realisation of an elegant and appropriate design. The problem to be solved had altogether changed. It was no longer, " Given, a design to be realised in materials best suited to render the object a work of art suitable for wear as a personal decoration," but it was, " Given, a certain number of precious stones of exceptional size and value, for the combination and construction of an ornament which, whether suitable for wear or not, should be of a fixed value in money." Fine art workmanship shrinks from the solution of such a problem, when mechanical power and skill in construction is opposed to sound taste in the realisation of beauty and fitness of purpose.

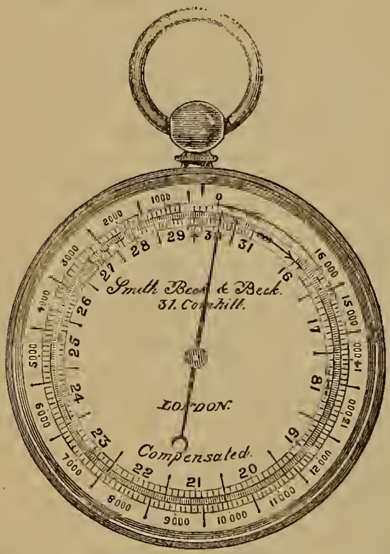
It was not until after the Great Exhibition of 1851 that much attention was paid to the perfectly consistent and generic character of the oriental design. The jewellery of the East had been up to that period regarded as only fit to be classed with the ornaments for personal decoration used by semi-barbarous peoples in all quarters of the world. A careful examination, however, of the examples exhibited in 1851, and of others which subsequently found their way to Europe, showed these Eastern jewellers had really laid the foundation for much of the tradition which had existed from a very early period in the goldsmiths' and jewellers' art as exercised in the West, and that, however rude or uncouth the surface finish of stones and gold work might be, the ornaments were instinct with the true spirit of decorative design. Nor could it be said that, considering the primitive means at the disposal of the workers in gold and silver, they fell below the Western workmen in true skill. With an instinctive perception of harmony of colour, the primitive hue of stones, brilliantly tinted translucent enamel, filigree work, and twisted wire work, were brought to bear on jewelled constructions, in which skill of hand was only secondary to the perception of beauty that governed the production of the various objects which Oriental tradition and custom led the jeweller to execute. It was only when under some European or other foreign influence, when the worker attempted to adapt his art to forms suited to meet Western requirements, that he failed. The want of congruity between the general form as adapted to European use, and the traditionary decorative details, was fatal to success.

(*To be continued.*)

ANEROID BAROMETER.

For many years metallic or aneroid barometers have been substituted with advantage for the dial or wheel barometers, the indications of which are only of inferior precision. These are based on the elasticity and the flexion of metals formed into thin plates. A flattened brass tube, the section of which is elliptical, is exhausted of air and carefully closed. It is curved in the form of an arc of a circle, and fixed at its middle point, so that the disengaged extremities of the two halves of the tube can oscillate on either side this fixed point. When the barometric pressure increases, the pressure flattens the tube, which effect causes the curvature of the two arcs to augment, and their free extremities approach each other; the opposite takes place if the pressure diminishes. The disengaged extremities of the tube are connected with levers, which move the axis of a cogged sector. The needle of the dial, which is connected by a pinion to this sector, moves either in one direction or the other, and in this manner traverses the divisions on the dial, which are engraved by comparison with a standard barometer. Such is the metallic barometer of Bourdon.

The aneroid was invented by Mons. Vidi, of France, and although patented in England in 1844, it was first generally introduced to the scientific world of this country at the meeting of the British Association at Swansea, in 1848, by Professor Lloyd. It has, however, been perfected since then, especially by Mr. Cooke, an English optician. There are now many varieties of these barometers, more or less reliable, but they all correspond as far as principle and general mechanism are concerned. It consists of a hollow metal cylinder, with thin and corrugated sides, which contract or expand according to the pressure of the atmosphere, the air within having been previously exhausted by the air-pump. The motion of the sides of the cylinder acts upon a principal lever, placed in the interior, and connected with two smaller levers, to one of which a chain is attached, working upon a roller; and to the axis of the roller a hand is fixed, exhibiting the variations of the atmosphere by means of an index on the face of the barometer.



The instrument requires, however, to be repeatedly compared with a mercurial barometer, being liable to changes from the elasticity of the brass chamber changing, or from changes in the system of levers which work the pointer. Though aneroids are constructed showing great accuracy in their indications, yet none can lay any claim to the exactness of mercurial barometers. The mechanism is liable to get fouled and otherwise go out of order, so that they may change 0·300 inch in a few weeks, or even indicate pressure so inaccurately and so irregularly that no confidence can be placed in them for even a few days, if the means of comparing them with a mercurial barometer be not at hand. Some of our leading English and French makers are, however, continually applying improvements with a view of counteracting these drawbacks, and we shall have an instrument before long which will not only serve for ordinary purposes, but also for the most delicate scientific operations. For the above illustration we are indebted to Messrs. R. and J. Beck, the well-known manufacturing opticians, of 31, Cornhill.

DELICATE TEST FOR GOLD.

Faraday's researches upon the nature of the thin films of gold and other metals, and upon the size of the finely divided particles of gold diffused through various liquids, are of a most interesting and refined character. Availing himself of the well-known reducing power of phosphorus, he floated small particles of it upon the surface of weak solutions of chloride of gold. In the course of twenty-four hours he found that the surfaces of the liquids were covered with films of metallic gold, which were thicker near the pieces of phosphorus, possessing the full golden reflective power of the metal, but becoming so thin by gradations as to be scarcely perceptible. They acted as thin plates upon light, producing the concentric rings of colours round the phosphorus at their first formation, though their thickness then could scarcely be the 1-100th, perhaps not the 1-500th of a wave undulation of light. By treating very dilute solutions of gold with phosphorus he obtained the metal diffused through the liquid in extremely fine particles, producing a beautiful ruby colour. These particles, when in their finest state, often remain unchanged for months, and have all the appearance of solutions, but they never are such, containing in fact no dissolved but only diffused gold. The particles are easily rendered evident by gathering the rays of the sun (or a lamp) ino a cone by a lens and sending the part of the cone near the focus into the fluid; the cone becomes visible, and though the illuminated particles cannot be distinguished, because of their minuteness, yet the light they reflect is golden in character and seen to be abundant in proportion to the quantity of gold present. Portions of gold so diluted as to show no trace of gold by colour or appearance, can have the presence of the diffused solid particles rendered evident by the sun in this way.

The French crown jewels exhibited at the French Exhibition are but a tithe of those which belonged at one time to the French Monarchy. The first inventory of these jewels is signed La Vrilliere, and dated 10th September, 1691. A century later, on the 1st October, 1784, the diamonds of the crown were, by an *arrêt* of the Royal Council, signed by Baron de Breteuil, deposited in an especial jewel-chamber set apart for their reception. According to the inventory drawn up in 1774, the number of single diamonds was estimated at 7,482. In 1791, at the epoch of the French Revolution, another inventory was drawn up by order of the Constituent National Assembly, when it was found that the number of diamonds had increased to 9,547. The inventory of 1791 contains 300 pages. At the head of the list of figures is the diamond called the "Regent," which is thus described—"A superb diamond, brilliant, square in form, rounded at the corners, weighing 136 13-16 carats." This diamond weighed originally 410 carats, but was reduced by unskilful cutting. According to the list, the value of the diamonds in the collection amounted to 16,730,403 livres, the pearls to 996,700 livres, and other precious stones to 5,834,490 livres. In order to arrive at the present value of these jewels, these sums must be tripled. The collection, as per Revolution inventory, has become, however, greatly reduced, and no official catalogue has since been published.

TRADE RECIPES, &c.

Straightening Arbors.—When arbors get bent in hardening, they can be easily and effectively straightened by placing them on a piece of soft iron, and striking them on the hollow side with the pin of the hammer. Arbors should be tempered in oil, and not by bluing, as is the practice with some watchmakers; a more regular and uniform temper is obtained by smearing them with oil and burning it off.

Worn Rims.—It is a great annoyance to watch-wearers to have the rim of hunting-cases so worn by the friction of the springs that they will not close tight, or perhaps not stay closed at all. This trouble can often be remedied by undercutting the rim at such an angle that the spring will draw the case tight. It is difficult to do this neatly with a graver or other hand tool, and the ordinary steel ratchet wheel, taken from the material box and mounted on the lathe as a cutting-burr, will be found more to the purpose. A wheel should be selected with very fine teeth; and if not hard, it should be hardened, the same as any other cutting-tool, and mounted on the live spindle in the most convenient manner. This burr will cut and finish a square hole in a main-spring so narrow as to be difficult to punch, besides saving the risk of breaking small files in finishing the hole; the spring to be cut should be bent backwards, so that the hole will not be cut too long. It will also cut solder from the grooves in spectacles after mending, and do a hundred other little things that no file will do.

To protect stones, enamel, chasing, and engraving from the effects of heat in hard soldering, cover the exposed part with a thick paste of whiting and water. This simple process, which may be new to some, is much cleaner and safer than any other method in use.

Patent Base for Artificial Gems.—The base of these gems as patented by the superintendent of the Royal Porcelain Works at Berlin, is a fluid obtained by melting together 6 drachms carbonate of soda, 2 drachms burnt borax, 1 drachm saltpetre, 3 drachms minium, and 1½ ozs. purest white sand.

Boettger's Artificial Rubies.—Moisten recently precipitated and well-washed hydrate of alumina with a few drops of neutral chromate of potassa, and kneaded so that the mass assumes a scarcely perceptible tinge; then roll it out into small sticks, about the thickness of a finger, and dry them slowly, filling up any cracks that may occur in drying with fresh hydrate of alumina. When perfectly dry, warm a stick a little, and bring a portion into the end of the flame of a compound (oxyhydrogen) blow-pipe. In a few minutes several minute balls form, of such intense hardness as to scratch quartz, glass and granite. These, however, when cut and polished, appear slightly opaque.

Boettger's Artificial Emeralds.—They are made in the same manner as his rubies, by employing nitrate of nickel instead of the chromate of potassa. The same plan, substituting oxide of chromium for chromate of potassa, will produce gems of considerable hardness and beauty, though slightly opaque; which may, however, be lessened by the addition of a very little silica.

To Cut Glass Round or Oval without a Diamond.—Scratch the glass around the shape you desire with the corner of a file or graver; then, having bent a piece of wire to the same shape, heat it red-hot and lay it upon the scratch; sink the glass into cold water just deep enough for the water to come almost on a level with its upper surface.

Preparation of Solution of Gold.—The gold solution for gilding is prepared by dissolving gold in three parts of muriatic acid and one of nitric acid, which forms the chloride of gold. This is digested with calcined magnesia, and the gold is precipitated as an oxide. The oxide is boiled in strong nitric, acid, which dissolves any magnesia in union with it; the oxide, being well washed, is dissolved in cyanide of potassium, which gives cyanide of gold and potassium, thus:—

Substances used.	*Substances produced.*
Oxide of Gold ... ...$= A u O$	Cyanide of Gold and Potassium $= K Cy + Au Cy$
2. Cyanide of Potassium$= 2 K Cy$	Potash ... ...$= K O$

$$A u o + 2 K Cy = K O + (K Cy + Au Cy).$$

By this method a proportion of potash is formed in the solution as an impurity; it is not, however, very detrimental to the process. In preparing the oxide of gold, there is always a little of the gold lost, to recover which the washings should be kept, evaporated to dryness, and fused. Another and very simple method is this:—Add a solution of cyanide of potassium to the chloride of gold, until all the precipitate is redissolved; but this gives chloride of potassium in the solution, which is not good. In the preparation of the solution by this means there are some interesting reactions. As the chloride of gold has always an excess of acid, the addition of cyanide of potassium causes violent effervescence, and no precipitate of gold takes place until all the free acid is neutralised, which causes a considerable loss to the cyanide of potassium. There is always formed in this deposition a quantity of ammonia and carbonic acid, for the deposition of the cyanate of potash; and if the chloride of gold be recently prepared and hot, there is often formed some aurate of ammonia (fulminate of gold), which precipitates with the cyanide of gold. Were this precipitate to be collected and dried, it would explode when slightly heated. On previously diluting the chloride of gold, or using it cold, this compound is not formed. After the free acid is neutralised by the potash, further addition of the cyanide of potassium precipitates the gold as cyanide of gold, having a light yellow colour; but as this is slightly soluble in ammonia and some of the alkaline salts, it is not advisable to wash the precipitate, lest there be a loss of gold. Cyanide of potassium is generally added until the precipitate is redissolved, consequently much impurity is formed in the solution, namely, nitrate and carbonate of potash, with chloride of potassium and ammonia. Notwithstanding, this solution works very well for a short time, and it is very good for operations on a small scale. —O. Byrne.

Gilding on Glass.—A new process by M. Dodon is thus given by the *Moniteur de la Céramique*:—Gold, chemically pure, is dissolved in aqua regia (1 part nitric and 3 parts hydrochloric acid). The solution effected, the excess of acids is evaporated on a water bath till crystallisation of the chloride of gold takes place; it is then taken off, and diluted with distilled water of such quantity as to make a solution containing 1 gramme of gold to 200 cubic centimeters of liquid. A solution of caustic soda is then added until the liquid exhibits an alkaline reaction. The solution of gold is now ready for reduction. As a reducing agent an alcoholic solution of common illuminating gas is used. This is prepared by simply attaching a rubber tube to a gas jet, and passing the current of gas for about an hour through a quart of alcohol. This liquid (which should be kept in a closed vessel) is added in quantities of from two to three cubic centimeters to 200 cubic centimeters of the alkaline solution of gold beforementioned; the liquid soon begins to turn to a dark green colour, and at length produces the metallic layer of gold of known reflecting power. As an improvement on the process, as well as for convenience in executing it, there may be added to the alcoholic solution of gas an equal quantity of glycerin (28° to 30° Baumé), previously diluted with its own volume of distilled water. If the gold employed is an alloy, the foreign metals must in all cases be first removed, and especially the least traces of silver, because the very smallest quantity of this metal totally prevents the regular and uniform deposition of the gold.

THE SWISS WATCH TRADE IN 1867 AND 1878.

OUR last issue contained some extracts from the *Revue Chronométrique* relating to the French watch and clock trade in 1867 and 1878, and in the present we shall institute a similar comparison as regards the Swiss watch trade, drawing our information from the same source.

The annual production of Switzerland in 1867 was as follows:—

Movements:	Fontaine-Melon	260,000
	Val-de-Travers	30,000
	Sonceboz	120,000
	Various other places	90,000

making a total of six hundred thousand movements.

Watches:	Canton de Neuchâtel	800,000
	Bernese Jura, and Vaud	300,000

representing together a value of over 40 millions of francs.

Geneva manufactured 100,000 watches yearly (90,000 in gold), worth 15 millions of francs. In addition to watches Switzerland sent also large quantities of watch tools abroad, but the cost of some 600,000 movements drawn from France is estimated to counterbalance the export of the former. About 50,000 unfinished movements were also sent to England and America. A report submitted by Dr. Hirsch, of the Neuchâtel Observatory, corroborates the above figures.

In 1878 this state of affairs is somewhat altered, and the production of Swiss watches, which had increased with undue rapidity, has met with a check. Manufacturers, elated with success, flooded the markets with such goods as were sure to bring discredit on the Swiss watch trade, and thus caused a reaction which has been severely felt. Watch manufacturers abroad were not slow in taking advantage of the industrial blunder of their Swiss rivals, and supplanted the *pacotille* of the latter with something more worthy of confidence. Several important French and American markets were consequently closed to Swiss goods, and while Swiss imports from France have increased, their exports to that country, and to the United States, have considerably diminished.

Mons. Saunier asserts that if some of the Swiss fabricants suffer for their thoughtlessness and want of patriotism, it is because they would not listen to the wise admonitions of Dr. Hirsch. As the disinterested advice of that gentleman may be useful to others besides Swiss manufacturers, we give a translation:—

"The dangers which might threaten us are all to be found, or rather manifest themselves, in the persistent lowering of prices. Admitting that secondary and partly transitory causes may have contributed towards this state of affairs, we must not delude ourselves by imagining that it is merely the effect of a crisis, but rather recognise it as a necessary and legitimate consequence of the general development of modern industry, as an application of the universal law of competition to our industry."

It must, however, not be supposed that the Swiss watch trade is declining; it is simply undergoing a period of dulness, the inevitable result of overproduction and a plethoric state of the market. Strenuous efforts are now made in several Swiss horological centres, particularly Geneva, Saint Jmier, and Cortébert, to fight their most formidable opponents with their own weapons, the machines.

"Silveroid" is the name of a new metal which has just been introduced in America in the manufacture of table-ware. "It has fine texture, is susceptible of a high finish, and can be supplied at much less cost than anything heretofore used as a substitute for real silver."

QUERIES AND ANSWERS.

D. G., H., would be obliged to any reader who could give a few simple directions for making a small battery for gilding and plating.

S. B., N.—Is it true that the frosting of aluminum will prevent its tarnishing on exposure to air, and how is that process done?

Yes. Your object may be gained by simply plunging the metal in a solution of caustic potash.

W. W., F.—The following rules will enable you to convert degrees of Celsius and Réaumur into equivalent degrees of Fahrenheit with despatch:—

To convert degrees of Centigrade into degrees of Fahrenheit, multiply the degrees of Centigrade by 9, and divide the result by 5; then add 32.

To reduce degrees of Fahrenheit to the corresponding degrees of Centigrade, reverse the above process. First deduct 32 from the degrees F., then multiply the difference by 5, and lastly divide the result by 9.

To reduce degrees of Réaumur to the corresponding degrees of Fahrenheit, multiply the degrees R. by 9, divide by 4, and then add 32.

To reduce degrees of Fahrenheit to corresponding degrees of Réaumur, reverse the above process.

To reduce degrees of Réaumur to Centigrade, add to the degrees of Réaumur their one-fourth part.

To reduce degrees of Centigrade to Réaumur, deduct one fifth part.

F. S.—The length of a Geneva cylinder can be obtained by the following method:—Take off jewel covers, screw on the cock, and take the distance outside the jewel holes with the pinion gauge—this is the length of pivots and all. The diameter is obtained from the scape-wheel thus:—If the foot of the cylinder is held between two teeth and against the point of one, the heel of the next must be quite free of the cylinder. With a depthing tool, the watchmaker can put the scape-wheel and cylinder into it, and see if the cylinder has the same freedom inside and outside—that is, the tooth should have equal "drop" into the inside and to the outside of the cylinder, but the point of the tooth should not drop too far into the cylinder; just enough to be safe is all that is required. There are three dots, one on the plate close to the edge of the balance, and another on the rim of the balance to mark the place for the hair-spring stud, and when the balance is at rest the dot on it is close to the middle one on the plate. In new watches these dots mark the extent of the balance of impulse—that is, a tooth escapes when the dot on the balance reaches the outside dots on the plate. Before the balance is riveted too tight, the cylinder should be put in and tried, and the balance turned round on the cylinder until the teeth escape at the dots. You will thus get the banking, and also the escapement, right at once.—S.W.

F. S.—For a more elaborate answer to your query, we refer you to No. 9, *Treatise on Modern Horology*.

NIGHT WATCHES.

A NOTABLE improvement in watches is reported from Chaux-de-Fonds, Switzerland. By a peculiar process the figures in the dial are rendered luminous, so that if exposed once during the day to the sunlight they remain phosphorescent and visible throughout the night. It is stated that preparations are made for the production of these watches on a large scale.

BRONZES.

By C. D. E. Fortnum, F.S.A.

Continued from page 36.

We have abundant proof that the mines of copper ore existing in our own country were worked by the Romans. Perhaps the most distinct evidence is to be found in the island of Anglesey, where not only the stone pounders or hammers with which they (and probably still earlier miners) detached the ore from the rock (previously heated and then disintegrated by the action of cold water, as described by Tacitus) have been discovered, but cakes also of the fused metal from time to time and in various places. One of these cakes, mentioned by Pennant in his tour in Wales, is inscribed with the words, SOCIO ROMÆ, and in smaller letters, Natsol. Others have been found on the side of the Parys mountain; these, flat and circular in shape, are of pure copper, each weighing about 29 lb. 6 oz. It has been argued that these *massæ* must have each represented a value approaching to £600 of our money, allowing for the difficulty and labour of working with the primitive appliances then at command—a conclusion which may perhaps be open to some question.

The most important and abundant mineral of copper is the yellow double sulphuret of copper and iron, known as copper pyrites, though not so rich in that metal as the rarer grey ore, the simple sulphuret. It also occurs in smaller quantity as a carbonate, the harder and closer varieties of which are well known as the beautiful mineral called malachite, the product of Siberian, of Australian, and some other mines; also, but rarely, as the black oxide. The other minerals of copper need not detain us, nor may we attempt more than a slight explanation of the interesting process for its reduction to the metallic state.

First, after the mechanical operations of separating from the quartz and other valueless substances occurring in the lode, by pounding, washing, milling, etc., the ore is exposed to the action of flame in the roasting furnace, by which a portion of the sulphur is burned off, leaving the remainder in the state of a sub-sulphate of the oxides of copper and iron. By fusion with silicious mineral and some unroasted ore, the iron is separated as a slag, and repeated and long-continued roasting in the reverberatory furnace supervenes to remove the sulphur and to oxidize. The next process is the reduction to the metallic state by driving off oxygen with the aid of charcoal in the reducing or blast furnace. The metal still contains many impurities, which are removed by the tedious and delicate operations of refining, after which it is run out into ingots or bars of the purified metal.

Next in importance to our subject is tin, a metal known from unrecorded times, which still retains its place and value in the manufacturing arts, particularly in connection with copper and with lead. It was known to Homer and to Hesiod, who describe the fusing of the mineral. The ores of copper are abundantly distributed; not so those of tin, which are of more local occurrence. Many remarkable and interesting subjects of inquiry arise from the fact that our own country is, and has been from the earliest ages, one of the chief sources from which this valuable metal has been derived. Unacquainted, as it would seem, with zinc in its metallic state, and only partially as an alloy of copper, the ancients well knew the use of its more noble fellow-metal, tin. The Phœnicians of old traded largely with England, taking their mineral cargoes from the Devon and Cornish ports, as they did also from Spain; and it seems probable that through them the sea-carriers of the ancient world, the countries bordering on the Mediterranean, and perhaps even Egypt and Assyria, were supplied with ore, this trade extending back to a very remote period. We must not, however, forget that from Arabia, from Persia, and perhaps from Northern India, supplies may have been occasionally obtained. The *Cassiterides* islands, the position of which was kept secret by the Phœnicians, but which are supposed to have been the Scilly group, or even a portion of the Cornish coast, were a source whence they conveyed tin to the Mediterranean shores. Diodorus and Strabo tell us that it was brought to Marseilles from Britain, and Pliny speaks of this metal—the *stanum*, or "white lead," the *kassiteros* of Homer—as being found also in Lusitania and Gallicia. In Ezekiel we read that the Tyreans received tin from Tarshish. It is first mentioned by Moses, in Numbers xxxi. 22, as part of the spoil of the Midianites, about 1452 B.C. Isaiah speaks of it as an alloy for other metals.

Tin also occurs in Ireland, in Bohemia and Saxony, in Gallicia and the north of Portugal, and in Sweden. In Asia it is found in the island of Banca, the peninsula of Malacca, in the western Australian colonies, and elsewhere in smaller quantities.

The principal mineral of tin is the oxide, which occurs in veins, and also in rounded grains, as "stream tin"; the latter is generally not so impure, the vein tin being more or less accompanied by iron, copper, arsenic, &c. Its reduction to the metallic state is a much more simple process than that for copper, tin being easily fused and the oxygen readily driven off. Indeed, the primitive method seems to have been nothing more than making a pile of the mineral mixed with small wood, firing it, and receiving the metal in a stone trough beneath. Interesting evidences of the early working for tin ore have been discovered at Carnon, where a pick formed of deer-horn, fixed in its own handle, was unearthed, at a depth of many feet from the surface, and associated with bones of extinct animals. Other picks, as also bronze celts, together with wooden shovels of Roman and of long preceding time, have been discovered in the stream tin workings of Cornwall. Blocks of tin are rarely found in the hoards of the bronze period, but some were discovered with bronze sickles at Hermannstadt, in Transylvania.

Bronze is produced by the melting together of these two metals, copper and tin, differing in colour from either of its constituent elements, as also in various other qualities. In place of two metals, one of a ruby colour, the other white, we have a closer substance of a golden brown. It is also a well-known fact that the bulk occupied by the same weight of the alloy is considerably less than that occupied by the two metals previous to their combination, the result being a great increase in hardness, perhaps due to the interpenetration of their atoms. Their aggregate fusibility is, moreover, much increased.

We have already stated that the normal relative proportions of the two metals is nine to one, but many variations of these proportions have been from time to time purposely approved, or in other cases may have arisen from the loss of tin during the process of fusion, or by the presence of other metals in the ores. One great difficulty in the fusion of bronze arises from the great volatility of tin by the absorption of oxygen when melted, a property which the presence of copper does not obviate. It is necessary, therefore, to observe great caution in the fusing and casting, which should be effected as rapidly as possible, so that the proportion of tin remaining in the alloy may not be diminished to too low a standard. The tools of the ancient Egyptians were generally formed of a bronze containing twelve parts of tin to eighty-eight of copper, doubtless hardened, and tempered even to elasticity, by hammering, etc. Mr. J. A. Phillips tells us that experiments made by him upon antique coins and other bronze objects yielded the following results:—The Greek coins of Hoero and Alexander are of pine bronze, containing only tin and copper. The early Roman contain some lead.

(To be continued.)

Watch Glasses are manufactured at Trois-Fontaines (France) to the amount of a million of francs per annum, nearly three-fourths of this sum being for labour.

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from page* 36.)

IN 1663 Martinelli, of Spoleto, wrote a curious work describing various methods of constructing what he calls elementary clocks—that is, clocks which were set going by earth, air, fire and water—some of which could be made to show the time of day, the days of the week and month, the courses of the moon and planets, with the epact. Time was measured in the water-clocks by suffering that element to pass successively through the compartments of a drum-shaped cylinder acting as a pulley to a cord with a counterweight, the rapidity of the motion being determined by the quantity of the water, or the bore of the orifice through which it escaped. The motion of the earth or sand clock was regulated in a similar manner. In the air-clock time was measured by the pumping of a bellows, like those of an organ, the gradual escape of the air regulating the descent of a weight, which carried round the wheels, as in other time-keepers. In the fire-clock the motion was produced upon the principle of a modern smoke-jack, the wheels being moved by means of a lamp, which also gave light to the dial; and the clock could be made to announce the several hours by placing at each a corresponding number of crackers, which by certain contrivances were exploded at proper times. He tells us that these clocks offered considerable advantages to persons troubled with insomnia, or want of sleep, as they gave a soft light, and without noise marked the silent flight of time.

In Bagford's Collections in the British Museum, Harl. MSS. 5,931, is the following advertisement of a clock which was moved merely by the exhalations of a lighted candle:—"The Turkish Seraglio, in waxwork. The story of Queen Boadicia, &c. The Temple of Ephesus, &c.; and of Apollo; the vision of Augustus; and the six Sybils, &c., the fatal sisters that spin, reel, and cut the thread of man's life, &c. Moving figures, &c. An old woman flying from Time, who shakes his head and hour-glass with sorrow at seeing age so unwilling to die. Nothing but life can exceed the motion of the heads, hands, eyes, &c., of these figures, &c. Other curious pieces of clothwork, and rarities, &c. A clock like the long pendulums now in use, but internally different, the motions of the two hands and striking regulated without pendulum or balance or fly, by the exhalations of a lighted candle, not hid, but exposed, and of the same use as if placed in a candlestick, &c. Mrs. Salmon teaches the full art, sells all sorts of moulds and glass eyes, with other materials, and takes likenesses of gentlemen and ladies, in St. Martin's, near Aldersgate Street. Prices 6d., 4d., and 2d."

Mrs. Salmon removed soon after from St. Martin's-le-Grand to the "Golden Salmon," at Temple Bar, which she says was a more convenient for the coaches of the quality to stand unmolested. Her collection of wax-work figures was for half a century one of the most popular exhibitions in London, especially to country visitors.

We read in Faulkner' "History of Fulham and Hammersmith that the clock in Fulham Church steeple was the gift of an individual in order to exonerate himself from serving any office during his residence in the parish, as appears by the following extract from the parish books, dated August 14th, 1664:—

"Ordered, that Richard Goslinge, of this parish, brickmaker, bee and is from this day forward, during his abode in this parish, quitted from bearing any office off and belonging to the parish of Fulham, upon condition if the said Richard Goslinge doe, at his own proper costs and charges, give an able and substantial clock not under the value of £12, and yt the old clock bee given unto the said Richard Goslinge, which new clock is the voluntary gift of him the said Richard Goslinge, in consideration of the privileges aforesaid."

Sir Edward Lake, by his will, dated April 8th, 1665, gave as follows:—"To the church or chappell of Normanton, near Pontefract, in Yorkshire (if there be a church or chappell there, which I know not), where my paternall ancestors have lived for many years," a clock, and a sum "for the maintaining and keeping of it for ever." A Latin inscription in Normanton church refers to the gift.

In the "Calendar of State Papers," *temp.* Charles II., under date May 10th, 1666, we find a letter in French from M. de Marainville to M. de la Fabvollière, requesting him either to return to M. de Samborne the alarum clock which he, the writer, had lent him, or if it suited him, and he wished to keep it, to pay for it seven pieces, the price the clockmaker at Charing Cross offered for it.

On September 6th, 1667, the sight-loving Pepys went with his wife to Bartholomew Fair, and after witnessing a man whose legs were tied behind him dance upon his hands, next "went to see a piece of clockwork made by an Englishman—indeed, very good—wherein all the several states of man's age to 100 years old is shewn very pretty and solemne."

In the Camden Society's "Secret Services of Charles II. and James II.," vol. lii., are various accounts of payments made on behalf of the king, some of which were for clocks supplied to him. Thus, in the account up to April 3rd, 1668, is an item, paid "Humfry Adamson, for a clock by him sold for the chappell at Whitehall, £19 7s." In the account up to March 9th, 1682, is an item, paid "To W. Chiffinch, for so much money he paid Samuel Watson, for a clock he sold his late Ma'tie, which showes the rising and setting of the sun and moon, and many other motions, £215." His late Majesty must have been Charles I. In the account up to July 3rd, 1682, is an item, paid "To Mr. Knobb, by his Ma'tie's command, upon a bill for clockwork, £141." In the account up to December 9th, 1682, is a debit, "To Robt. Seignior for a clock bought of him, and set up in the Trea'ry Chambers, for the use of the Commissioners of his said Ma't's Trea'ry, £20." All these payments were made in the reign of Charles II.

In 1669, Cosmo III., Grand Duke of Tuscany, relates in his travels that he saw at the Royal Society of London a clock, the movements of which were derived from the vicinity of a loadstone; and it was so adjusted as to discover the distance of countries at sea by the longitude. This clock, says Mr. Weld, in his "History of the Royal Society," together with Hooke's magnetic watches, were on the occasion of the visit of illustrious strangers always exhibited as great curiosities.

The mechanism of Venice clock, which we have before described, was in one particular imitated in the clock of St. Dunstan's Church, Fleet Street, which was taken down in 1831. This remarkable clock, that projected over the street in the manner of those of several of the City churches at the present time, was set up in the year 1671. The artist, Thomas Harrys or Harris, received for his work the sum of £35 and the old clock. It appears by the parish books that on May 18th, 1671, Thomas Harrys, who was then living at the lower end of Water Lane, London, made an offer to build a new clock with chimes, and to erect two figures of men with pole-axes to strike the quarters. This clock was so constructed as to afford one dial-plate at the south front and another at the east end of the church. All this he proposed to perform, and to keep the whole in constant repair, for the sum of £80 and the old clock, at the same time observing that his work should be worth a hundred pounds.

(*To be continued.*)

Prices Current for Gold and Silver.—Value Given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver, 4s. 6½d. to 4s. 9d. (variable according to quantity).

ENGLISH SILVERSMITHS AND THE PARIS EXHIBITION.

MR. EDWARD J. WATHERSTON, of Pall Mall East, has addressed a letter to the *Clerkenwell Press*, in which he shows that the duty now levied upon manufactured silver plate and the system of hall-marking are responsible for the want of success of the English silversmiths at the Paris Exhibition, where the grand prize has been awarded to an American firm. Mr. Watherston writes:—"As I have before argued, a duty, by which the price of silver plate is raised, and the hall-mark, which in point of fact is a hindrance to production, effectually prevent capital and cultivated labour from engaging in the trade. The result is that the silver trade is carried on by a few monopolists whose interests are to confine the business in a few hands, and who hug the duty and the system of hall-marking as being best calculated to prevent competition. If the trade were thrown open, as in my humble opinion it ought to be, the number of manufacturers would be rapidly increased, wholesome competition would arise, machinery would be laid down, every new improvement would be adopted, and the silver trade would soon regain its lost laurels. England need not fear America if only she be allowed fair play. The price—not the value—of labour in America is greater than that in England, and 3,000 miles of sea, and a number of unrequired profits on the part of importers and others, are quite sufficient protection for native industry. All that is wanted is absolute freedom on the part of manufacturers and dealers—the same freedom which so happily prevails in the case of other similar trades, that of electro-plate for example.

"We want no duties either upon our home trade or upon imported plate. There is no duty upon electro-plate; Messrs. Elkington, Martin, Hall, and others are quite able to keep American electro-plate out of England, so would silversmiths be able, if they adopted American modes of production, to keep American silver plate out of England. Shopkeepers would deal in, and the public would purchase, the best and cheapest, irrespective of nationality. If English silversmiths were beaten, it would simply be their own fault, and no one but themselves would have cause of complaint."—*Public Opinion*, September 28th, 1878.

A PULLMAN CAR IN GOLD AND SILVER.

THE model car sent to the Paris Exposition by the Pullman Company of America is 30 inches long, 8 inches wide, and is constructed entirely of gold and oxidised silver. It is furnished perfectly to the most minute detail. The rails upon which it stands are silver, and the wheels gold. The platform at either end is of gold, chased with crossed lines, to represent the uneven surface of the common platform. The body of the car is of oxidised silver exquisitely chased, and the doors of the same, while the knobs and hinges are of gold. Windows of plate glass, shaded by silk curtains, alternate with mirrors in rich frames. The revolving easy-chairs and footstools are of silver covered with silk velvet, and even the inevitable spittoon, no larger than a porcelain button, is perfectly made in silver. On the floor lies a handsome velvet carpet, and at each door the accustomed mat. The ceiling is tastefully frescoed, and tiny but perfect lamps of crystal are suspended therefrom, while the ventilators around the top of the car are minute doors of gold. Looking in at one of the windows, you see, locked securely in its closet, the stove in silver, which supplies warmth, and in another window you see that the dressing-room, with all its appointments, is not forgotten. The cost of the toy was £2,600, and its weight is 108 lb.

CIVIC JEWELLERY.

THE Paris Exhibition has taught us that we have still much to learn before we can successfully compete with Parisians as ornamental artists, but it is gratifying to notice that we are making such progress as will allow us to do so at no very distant period. We have had the privilege of inspecting a piece of goldsmith's work which is another proof of the superior taste and skill which is gradually asserting itself in our best workshops; and the chain and badge manufactured for Sheriff Bevan by Messrs. J. R. Williams and Son, of 108, Hatton Garden, would have made a creditable addition to our excellent but scanty display at the "World's Fair." The 18-carat gold chain is of the cable pattern, with plain oval connecting links, and intersected with five shields bearing the sheriff's private coat of arms, not engraved on a flat surface, as is usually the case, but beautifully chased and modelled. The badge is a combination of the sheriff's private arms with those of London and Middlesex and the Shipwrights' Company's. The insignia of the sheriff's office surround the badge, and a handsome garland of roses, shamrocks, and thistles in proper colours, and united with a graceful bow, complete the border. It is altogether a very happy design, displaying considerable originality, and the execution leaves nothing to be desired, the enamels being of beautiful and remarkably even tints, and the chasing and modelling bear the closest examination. It reflects no little credit on the above-mentioned firm to be able to state that every part of this magnificent ornament, including design, was produced in their own establishment.

GOLD MINE IN NEW YORK CITY.

WHEN the Appleton Building, in Bond Street, New York, was burned last year, the watches, jewellery, and silverware destroyed amounted to about a million dollars. The ruins were carefully worked over by the insurance companies, and all the larger masses of metal were taken out. Then the owners of the property subjected what was left to a thorough washing, and secured a handsome sum for their labour. For months after a number of juvenile miners worked at the rubbish, and one enterprising little fellow, it is said, secured enough to set himself up in business with a stand and newspaper route. Last spring the attention of two Western miners was attracted to the "mine," and after testing a bag of the dirt, made a liberal bid for the privilege of working over the refuse scientifically. The offer was accepted, and for the next two or three months their operations afforded much entertainment, if not instruction, to crowds of curious spectators. A real working gold mine in the heart of a great city was something of a novelty. The miners, Messrs. Pier and Roberts, have finished their work at last, and, according to the *Scientific American*, declare that the "find" was one of the richest they ever worked, that they secured over 60,000 dols. worth of precious metal, clearing some 20,000 dols. above expenses and the cost of their privilege. The average yield was over 1,000 dols. a day, one day's work bringing 1,700 dols.

Silver Bells.—A peal of twenty-eight silver bells has arrived at Eaton Hall, the seat of the Duke of Westminster, for the tower of the chapel attached to the hall. The largest bell, which weighs more than two tons, and is in the key of F—the complete set making two complete octaves and three notes above—bears the following inscription:—"This peal of twenty-eight bells was cast at Louvain for his Grace the Duke of Westminster, by S. Van Aerschodt, A.D. 1877." The referee appointed to certify to the tone of the bells was Dr. Stainer. It is said that the cost of the peal is £30,000.—*The Architect.*

THE DIAMOND.

THE following letter, signed F.R.M.S., appeared in the columns of the *Pawnbrokers' Gazette and Trade Circular* of the 23rd ultimo :—

"Referring to your extract from the *Watchmaker and Jewellers' Journal*, and to the letters that have lately appeared in the *Times* upon the identity of the diamond, all the writers upon the subject appear to have overlooked the one great characteristic feature of the diamond; it is this, you can see into the gem, but not through it. If your readers will take say a brilliant ring set transparent, place the end of the finger close to the back of the diamond, and look into the same with a watchmaker's eye-glass, they will fail to see the magnified skin of the finger through the stone; take an imitation, and you will see the grain of the skin through every part. Take a diamond set solid at the back, you cannot see through it; take an imitation set in the same way, you will see through to the foil at the back. Again, place a loose brilliant in the palm of the hand, you will see the magnified grain of the surrounding skin, but not through the stone; this is due to the highly refractive nature of the diamond. The ruby, sapphire, and other gems possess the same properties, only in a much inferior degree.

"In April, 1867, I exhibited at a *soirée* of the Royal Microscopical Society a diamond containing organic remains—an organism embedded in a 1-carat brilliant. When viewed with the microscope, it was covered with spikes like the back of a hedgehog when rolled up, but from the highly refractive nature of the diamond it defied all my attempts to get an effective illumination. When placed in the forceps, and the light from the mirror thrown upon the gem, the effect was gorgeous in the extreme; only a faint ray of light enclosed the objective (a large angle ½-inch by Ross), but it brought me all the colours of the rainbow. It was only by placing a large stop in the object glass, thereby cutting off some of the oblique rays, that I could obtain anything like a satisfactory performance. Recent researches have proved that the chemical equivalents of diamond and quartz are alike. This has opened up a very wide field for speculation."

Ornaments in Mourning.—It has been decided in circles which give *ton* to modern fashions that the following rules should be observed as to mourning-jewels :—In the first period after a great loss, when our heart is supposed to be in utter desolation, the least jewel, were it even of hardened wood (which, by the way, is far from pretty), is altogether prohibited. When time has somewhat softened our grief, jet may make its appearance, but at first very soberly and sparely; little by little it may come out in greater quantity, until at last it is showered profusely over the whole toilet. In half mourning amethysts are allowed, and form extremely elegant *parures*. In England we have seen silver and even gold jewels worn in deep mourning with heavy crape. In France very little crape is worn, but no silver or gold are allowed, even in half mourning. Black crape collars and sleeves are worn during the first year, and widows' caps are of black *crepe lisse*.

It is stated that films of gold and other metals can be obtained by means of electricity of sufficient thinness to transmit light. The films are obtained by causing electric sparks to pass from wires of the required metals, passing into glass tubes of rarefied air or other gases, when the particles of metal, detached from the wires by the sparks, become deposited on the glass, forming an excessively thin film, quite continuous, it is said, under the microscope. Of the metallic films thus produced gold transmits a fine green light; silver gives a fine blue colour, copper dull green, platinum a bluish grey, zinc a deep bluish grey, iron a tint nearly neutral, but inclining to brownish, and cadmium, like zinc, a bluish grey.

SCOTCH PEARLS.

AT one time Scotch pearls were almost as well known as that now more popular product of the north country, Scotch whisky; and some very fine specimens of native gems are to be seen in the Regalia of Scotland at Holyrood. In the early days of the period, however, "when George the Third was king," the fishery for pearls, which had been carried on with considerable success in different streams for many generations, was generally abandoned, and it is only within the last twenty years that it has again attained much importance. Unlike the Oriental pearl, which is brought up from the depths of the ocean, the Scotch pearl is the produce of a mussel inhabiting fresh waters, and found principally in the shallow waters of the Doon, the Perth, the Spey, the Connor, the Tay, and one or two other streams, and in some of the lakes connected therewith. During the past summer a very good harvest has been reaped in the Clyde, and large numbers of divers have been engaged searching for the gems with a fair share of success. The diving is a comparatively simple process, involving few of the dangers attending the operations of the divers who go down to the bottom of the open sea at a depth of twenty or thirty fathoms, off the coast of Ceylon. The fresh-water mussel-diver has merely to wade into the water, stooping down to collect the precious bivalves. Sometimes experienced fishers will proceed breast deep into the water, immersing the whole body as they search for the molluscs, and at such times an unlucky step may involve considerable discomfort, if not actual danger. The prices offered are, however, sufficient inducement to several persons to devote their energies to the work for several months in the year. Large gems are comparatively rare, though many have been found worth £60 or £80 a-piece; but very few mussels need be gathered to collect a number of small "seed" pearls, which always find a market if of good colour. The best fresh-water pearls are of a pinkish hue.—*Globe.*

OBITUARY.

WE deeply regret to have to announce the death of Messrs. Charles Wood Denham and Christopher John Denham, father and son, who were passengers by the ill-fated "Princess Alice." Mr. Denham, senior, was 53 years of age, and had been for 16½ years town traveller and head clerk to Messrs. Atkin Bros., the well-known silversmiths and electro-platers of Charterhouse Street, and was very much respected by his employers and the trade. His son, aged 26, for several years traveller for Messrs. W. & J. Sissons, electro-plate manufacturers, of Sheffield, was to have entered the service of Messrs. Englefield & Mann, jewellers, of Hatton Garden, on the 5th ultimo, but before assuming his fresh duties he wished to have a day's outing, which unfortunately proved to be their last.

TESTIMONIAL TO MR. CHRISTOPHER ROWLANDS.

MR. CHRISTOPHER ROWLANDS, for ten years treasurer of the Clock and Watch Makers' Asylum, was presented with a silver salver on the 21st ult. at the board-room of the asylum, as a recognition of the valuable services rendered to the above institution. A tea-service, presented to Mrs. Rowlands, supplemented the salver—a handsome piece of plate, weighing 136 ozs., and bearing the following inscription :—

"Clock and Watch Makers' Asylum.—Presented to Christopher Rowlands, Esq., by the committee and friends of the above institution, in remembrance of his constant advocacy of its claims, and in testimony of his zealous exertions as treasurer, from 1868 to 1878, during which period the asylum was greatly extended, and its endowment fund more than doubled. Sept., 1878."

THE ELECTRIC STOP-MOTION.

By W. H. Bailey.

A Paper read before the Scientific and Mechanical Society.

(*Continued from page* 39.)

The application of the invention to drawing frames will be seen by an inspection of this machine. The slivers, before they reach the drawing rollers, are made to pass between rollers which we may describe as electric rollers, the bottom one of which is fluted, and revolves in bearings attached to the machine frame. The top rollers are made short, so as to allow of there being one for every pair of slivers which is passing through the frame, and they revolve in plates secured to a plate which is called a back plate, which is electrically insulated from the rest of the machine.

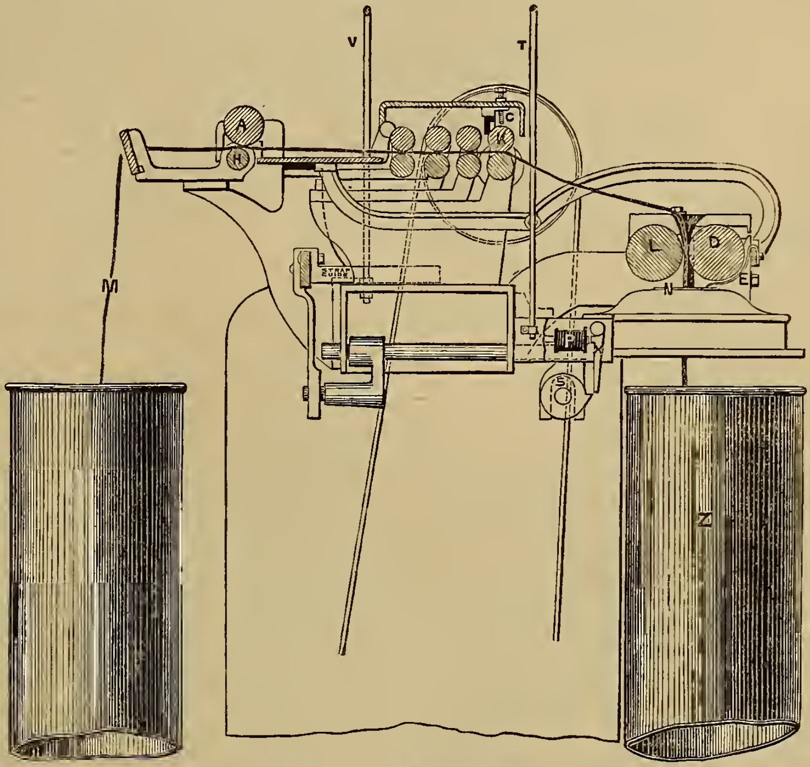


Fig. 2.—Drawing Frame.

On the frame is a small electro-magnet, and the stop-motion and strap-fork. The top series of electric rollers are kept from being in contact with the bottom one by means of a non-conducting cotton sliver, and the upper and lower rollers being insulated from each other by the non-conductors, the passage of the current is not possible; but supposing the sliver to break, the rollers come in contact, the circuit is completed, and the machine is stopped instantly. When the cotton laps on the drawing rollers, the stoppage is obtained as follows:—These drawing rollers, both top and bottom, are in electrical contact with the machine frame, and as is usual, are covered by the plates of the top clearers which are placed at short distances from them, and are attached to the insulated back plate. The top clearers, therefore, are in electrical contact with one pole of the magneto-electric machine, and the drawing rollers in contact with the other. When the rollers work properly, the distance between the upper and lower rollers is of a well-defined character, but should the sliver lap over either top or bottom roller, the distance between the centres increases, which raises the top roller, and so comes in contact with the projection from the top clearer, and this produces electrical contact, stopping the machine as before. The callender rollers are insulated from each other by much the same simple means which I have just described. Where the sliver is properly passing through, they are separated, no current passing; if, however, the sliver breaks in one of the funnels, then the rollers having nothing to keep them apart causes contact to result; the circuit then being complete, the operation becomes suspended, because the machine is stopped until the ends are pieced up. The last operation in connection with this ingenious mechanism, which I think appeals to us in consequence of its great simplicity, is when the front cans become full; when the required amount of sliver has accumulated in a can, the tube wheel is lifted up very slightly, which completes the circuit, and stops the machine as before.

We will now proceed to the roving or intermediate frame. Here it is requisite for the stop-motion to act in two cases which are provided for the prevention of "single"; first, when the end breaks before it reaches the drawing rollers; and secondly, when a bobbin in the creel becomes empty. By them these causes of single are guarded against by the adoption of an "electric roller," round which the ends pass before they reach the drawing rollers. The breaking of an end or the finishing of a bobbin will cause electric connection to take place with this roller, and thus stop the machine. How the electro-magnet gets action in the Intermediate frame will be understood by an inspection of the drawing Fig. 3a. After the explanation which has already been given, it will be scarcely necessary to describe in detail what has already been seen in connection with this machine. Before I conclude, I may say that the manufacturers of these machines, Messrs. Howard and Bullough, have been enabled to introduce them extensively in the manufacturing districts of this country, the United States, and other foreign countries with success; and I think that, from what we have seen of it this evening, you will agree with me that, among the many valuable inventions used in the cotton manufacture, this invention will continue to hold a leading position.

(*To be continued.*)

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PATENTS.

Applications for Letters Patent.

3595. Joseph Clark, of Liverpool, in the county of Lancaster, for an invention of "An improved safety fastening for studs, buttons, brooches, and analogous articles."—Dated 11th September, 1878.

3601. James Witherspoon, of Fox Court, Brooke Street, Holborn, in the county of Middlesex, for an invention of "Improvements in the cases or frames of barometers."—Dated 11th September, 1878.

3718. Edward Thomas Hughes, of the firm of Hughes and Son, patent agents, of 123, Chancery-lane, London, for an invention of "Improvements in musical boxes."—A communication to him from abroad by Messrs. Metert and Petite, of Geneva, Switzerland.—Dated 20th September, 1878.

3766. Martin Lowenstein, of Birmingham, in the county of Warwick, manufacturing jeweller, for an invention of "Improvements in buttons, solitaires, sleeve-links, studs, and other dress fastenings and ornaments."—Dated 24th September, 1878.

3774. Thomas Casson, of Denbigh, in the county of Denbigh, bank manager, for an invention of "Improved means and apparatus for working clocks and bells."—Dated 25th September, 1878.

3787. Alfred Burgess, of Birmingham, in the county of Warwick, jeweller, for an invention of "Improvements in spring bracelets, scarf-slides, and other rings."—Dated 25th September, 1878.

Patents which have become Void.

2985. William Robert Lake, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, for an invention of "Improvements in watches and similar timekeepers."—A communication to him from abroad by Albert Henry Potter, of Chicago, Illinois, United States of America, Manufacturer.—Dated 25th August, 1875.

Notices to Proceed.

3148. John Vernon Hope, of Crosby, in the county of Lancaster, has given notice in respect of the invention of "Improvements in the manufacture of rings, links, and other like articles usually welded, and in apparatus for manufacturing the same."

1789. William Borthwick Smith, of Warwick Row, Coventry, in the county of Warwick, has given the like notice in respect of the invention of "Improvements in watches, parts of which improvements are applicable to other time-keepers."

1840. George Lund, of the firm of Lund and Blockley, of 42, Pall Mall, in the city of Westminster, manufacturers, has given the like notice in respect of the invention of "Improvements in apparatus for synchronizing or setting clocks or other time-keepers."

3082. Hermann Francis Jung, of 4, Charles Street, in the parish of St. James, Clerkenwell, in the county of Middlesex, watchmaker, has given the like notice in respect of the invention of "Improvements in watches and other timepieces."

2467. And Charles Shepherd, of Alexandra-road, St. John's-wood, in the county of Middlesex, has given the like notice in respect of the invention of "Improvements in electro-magnetic clocks."

Patent Sealed.

1664. Walter Henry Collins, of Great King-street, Birmingham, manufacturing jeweller, for an invention of "Improvements in the manufacture of solitaires, studs, and other similar articles."—Dated 25th April, 1878.

Grants of Provisional Protection for Six Months.

3316. Jean Tetzis, Professor, of Galatz (Greece), for the invention of "Improvements in clocks, watches, and other time-keepers."

3271. Friedrich Hermann Felix Engel, Civil Engineer and Patent Agent, in the city of Hamburg, Germany, for the invention of "Improvements in stud-fastening."—A communication to him from Otto Rafflenbeul and A. Kàhl, both of Hamburg, in the German Empire.

3409. William Merchant, of 5, Southampton Buildings, in the county of Middlesex, for the invention of "Improvements in the fasteners for brooches and other articles."

Patents Granted in Foreign States.

United States of America.

Re-issues.

8273. William S. Hicks, of New York, N.Y., for "Watch-chain bars."—Patent No. 187,851, dated 27th February, 1877.—Application filed 20th May, 1878.

204,149. Louis Heckmann, of Wrentham, Mass., assignor of two-thirds of his right to William H. Wade and Edward P. Davis, of the same place, for "Wire-trimming for jewellery."—Application filed 12th March, 1878.

204,150. Charles T. Higginbotham, of Springfield, Mass., assignor to the Hampden Watch Company, of the same place, for "Winding-clicks for watches."—Application filed 10th April, 1878.

204,175. Henry Thompson, of Providence. R.I., for "Repeating-clocks." Application filed 16th March, 1878.

204,265. Jacob F. Traub, of Detroit, Mich., for "Spectacle-frames.—Application filed 13th April, 1878.

204,266. Jacob F. Traub, of Detroit, Mich., for "Eyeglasses."—Application filed 3rd April, 1878.

204,287. Geo. Bichsel, of Sedalia, Mo., for "Watch-regulators."—Application filed 16th April, 1878.

204,328. George Hills and Dwight B. Hills, of Plainville, Conn., for "Clock-cases." Application filed 27th March, 1878.

204,502. E. A. Osselin, o Paris, France, and Abraham Meyer, of Syracuse, N.Y., for "A galvanic ring, bracelet or necklace."—Application filed 24th August, 1877.

204,508. Wm. S. Shirk, of Anderson, Ind., for "Actuating Mechanisms for Calendar-clocks."—Application filed 11th May, 1878.

204,548. Wallace Durand, of Newark, N.J., assignor to Durand and Co., of the same place, for "Bracelets."—Application filed 20th March, 1878.

204,800. Henry A. Church, of Providence, R.I., for "Ornamental chains."—Application filed 3rd December, 1877.

205,037. Gilbert H. Blakesley, of Bristol, Conn., for "Clocks."—Application filed 1st April, 1878.

205,142. J. H. Rouse, of Somerville, assignor of one half of his right to Austin J. Coolidge, of Watertown, Mass., for "Time-indicators for letter-boxes."—Application filed 15th April, 1878.

8300. Louis Heckmann, of Plainville, Mass., assignor of part interest to William H. Wade and Edward P. Davis, for "Ornamental scrollwork for jewellery."—Design No. 10,288, dated 30th October, 1877.—Application filed 13th June, 1878.

BELGIUM.

45,740. C. Bescherer, for "A universal machine for cutting wheels for clock-work."—Dated 23rd July, 1878.

45,745b. C. Van Hove, of St. Gilles-Bruxelles, for "A gyral clock."—Dated 24th July, 1878.

45,852. Dutot-Vermoreken, for "A clock."—Dated 5th August, 1878.

FRANCE.

122,164. Tremeschini, Clerget, Soyer and Co., for "An improved aneroid barometer."—Dated 18th January, 1878.—Class 12.

122,197. Markowitsch and Scheid, for "A clasp for bracelets."—Dated 21st January, 1878.—Class 17.

122,203. Noel and Rohart, for "Manufacturing sulphate of alumina."—Dated 21st January, 1878.—Class 14.

THE WATCHMAKER JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

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HOROLOGY.

(*Continued from page 44.*)

XXXVII.—The Pendulum—*continued.*

Centre of Gravity is a point so situated in the centre of a body or system of bodies that are rigidly connected to each other, that any plane whatever, that passes through it, divides the body into two segments, the weights of which are exactly equal. In irregular-shaped bodies, the place of this point may be found mechanically, in several ways. One method consists in suspending the body successively from the different points of its surface, and, by an attached plumb-line, find in each case the direction of the vertical line through the body when it has come to rest. These lines will intersect each other at the point, and this point will be the centre of gravity of the body. The centre of gravity of a material pendulum may be determined mechanically by first balancing it on a knife-edge, and making a mark where the knife-edge is when the pendulum is balanced. Afterwards, suspend the pendulum and let it hang freely, then hang a fine plumb-line from the same point of suspension, and the point at which the plumb-line crosses the first line is the centre of gravity of the pendulum.

Centre of Gyration of a body, or system of bodies, is a point in which, if the whole mass were collected, a force applied at any distance from the axis of suspension would communicate to the mass thus collected the same angular velocity that it would have communicated to the system in its first condition. It is evident from this definition, that the point in question must have this property—that if the whole mass were united in it, the moment of inertia, or the power of resisting the effort of any force, will be the same as the moment of inertia of the body in its first state.

Centre of Oscillation is that point in a body, or system of bodies rigidly attached to each other, and oscillating about a fixed axis, into which if the whole mass were collected, the body would vibrate through a given angle, by the force of gravity, in the same time as in its first condition. The centre of percussion and the centre of oscillation in a pendulum are at the same point. The method of determining the centre of oscillation of the material pendulums was first given by Huyglens, in his celebrated work, *Horologium Oscillatorium.* His demonstration is this; "that if several weights, attached in any manner to an inflexible rod or pendulum, descend by the action of gravity, and if at any distance they are detached or disengaged from each other, each of them, in virtue of the velocity it had acquired during its descent, would mount to such a height that the common centre of gravity of all of them would reach exactly the same height as that from which it descended." The centre of oscillation may be found by measurement in the following manner. If several bodies be fixed to an inflexible rod, and suspended from a point, and each body be multiplied by the square of its distance from the point of suspension, and then each body be multiplied by its distance from the same point, and all the former products when added together be divided by the latter products added together, the quotient will be the distance of the centre of oscillation of these bodies from the said point.

In the material pendulum, the centre of oscillation is not always at a fixed point in the same pendulum, but varies in relation to the part where the spring bends. The centre of gravity differs from it in this respect, that it is a point that is always at the same place in the same pendulum, but generally both points are above the centre of the ball. For an iron rod pendulum, about 10 lbs. weight, the centre of the ball. In a wood rod pendulum about 10 lbs. weight, the centre of gravity is about ·8 of an inch, and the centre of oscillation about ·1 of an inch above the centre of the ball. In a gridiron pendulum of the heaviest class, weighing in all about 19½ lbs., the centre of gravity is about 4·75 inches, and the centre of oscillation about 2·30 above the centre of the ball. In a gridiron pendulum with the ball much lighter in proportion to the weight of the rod, and weighing about 16¼ lbs. in all, the centre of gravity is about 7 inches above the centre of the ball, and the centre of oscillation 3 inches; which will give some idea how these points vary according to circumstances.

The point of suspension of the pendulum has been supposed to be absolutely immovable; but in a mathematical sense there is no substance which does not yield to the pressure applied to it, and therefore as the pendulum swings from side to side the point of suspension oscillates also, and the whole frame work becomes truly a part of the vibrating mass. There are many well authenticated instances where a number of clocks, placed in close proximity to each other, would, under certain conditions disturb each other's motion. The one would stop the pendulum of the other, and after a time the stopped pendulum would resume its vibration, and in its turn stop the others, and so they would continue to stop and start again in alternate succession. This statement at first may seem incomprehensible, but it is easily explained by the following experiment:—attach the ends of a string to two supports, the walls of a room for instance, and from somewhere near the centre of the cord suspend two balls on two pieces of cord of equal length. If we set the one ball vibrating while the other is at rest the moving ball will immediately communicate its motion to the other. The ball that was at rest will gradually increase its vibrations in proportion as the other falls off, and finally the first started one will come to a standstill, then gradually resume its motion, while the other will in its turn stop and start again, and in like manner they will continue till they both come to rest. The pendulums of clocks are stopped and started again exactly from the same cause as these temporary pendulums we speak of. If two clocks be firmly placed on the same table, and if the table be very loose in its joints and be shaky, the same phenomena will occur as happened in the case of the two balls suspended from the loose strings and from the same cause—namely, the point of suspension of the one pendulum yielding to the motion of the other. If the same clocks be placed together on a firmer support they may not be entirely stopped, but the effect will be visible on the rates, if they are fine clocks and closely watched.

Conical Pendulums.—If we suspend a slender rod, with a ball attached to the end of it, in such a manner that it will swing freely in every direction, and impart to it a circular motion, it will describe a cone, the base of which will vary in diameter in proportion to the force of the circular motion that has been given to it. Pendulums that are the proper length to vibrate seconds in the usual way, if made to revolve in a circle and describe a cone, will only make one revolution in about two seconds, and one that vibrates twice will only make about one revolution in a second; and pendulums of other lengths will give the same results in a like proportion. This kind of pendulum is frequently applied to clocks that are intended for bedrooms of invalids, or in hospitals, or in other situations where silence is an object, and the usual ticking of a clock is objectionable. Of late years quantities of such clocks have been manufactured both in Europe and America. Pendulums of this construction are more liable to vary from irregularities in the motive power that drives them, than vibrating ones are; still we have seen clocks of this sort go well enough for all ordinary household purposes, when great care is taken to have the wheel work accurate, and the main spring properly adjusted by a fusee. Conical pendulums are sometimes applied to regulate the motion of chronographs, and the clock-work that drives equatorial mounted telescopes. In such cases it is desirable, in fact it is imperative, that a regular continuous motion should be given to the instrument, free from the usual jumping or intermittent motion that exists in clockwork regulated by a vibrating pendulum; a conical pendulum gives a continuous motion, but it cannot be made to give a regular one, although many supplementary contrivances have been devised for the purpose of helping it to do so. The necessity of using this kind of pendulum for this purpose has of late years been entirely obviated by an invention converting the intermittent motion that exists in clockwork that is regulated by the vibrations of a pendulum into that of a uniform continuous motion, and at the same time retain the accuracy that is derived from the vibrating pendulum.

Angular Pendulums are formed of two pieces or legs, like a sector, and suspended by an angular point. This pendulum is constructed with a view of diminishing the length of the common pendulum, but at the same time to maintain, or even to increase, the times of vibration. In this pendulum the time of vibration depends on the length of the legs, and on the angle contained between them conjointly—the duration of time of vibration increasing with the angle; consequently a pendulum of this construction may be made to oscillate in any given time. At the lower extremity of each leg of the pendulum is a ball or bob as usual; and if it vibrate half seconds when its legs are closed it will vibrate whole seconds when the legs are opened, so as to contain an angle equal to 151° 2′30″. This pendulum is used on occasions when it is desirable to have a pendulum to vibrate long portions of time, and when the situation will not admit of one of the usual construction; but it is not suited for any purpose where accuracy is required. The difficulty of compensating it and the great and fatal tendency it has to swing in an elliptical plane, renders it unsuitable for purposes where precision is an object.

(*To be continued.*)

THE TURNERS' COMPANY'S PRIZES.

THE competition for the above prizes, which were distributed at the Mansion House, was not very strong, the number of competitors being very limited in comparison to former years. The specimens in wood-turning showed considerable improvement, while the quality of diamond-cutting was not equal to former exhibitions, and although some of the work is very good it is not considered, on the whole, satisfactory. The Freedom of the Company and £10, which constitutes the first prize, were awarded to Mr. J. D. Snoek, of Hatton Garden; the Freedom of the Company and silver medal to W. Lack, Gray's Inn Road, and the third prize, a bronze medal, to Walter Lambert, Clerkenwell Green.

HALL-MARKING AND DUTY QUESTION.

MANUFACTURERS in many of our staple industries have of late years become painfully aware of American competition; but we doubt whether any of our manufacturing silversmiths ever thought of our Transatlantic cousins as rivals in their time-honoured craft. It is, nevertheless, true that a New York firm has carried away the Diploma of Honour for silverwork at the French Exhibition, an award the justness of which anyone, who has seen the Tiffany display at Paris, and who is not too prejudiced to be able to appreciate anything outside of his own country, must readily admit. It is certainly a startling fact, and may well cause our silverworkers to ponder. One thing is certain, the success which has attended American efforts in this direction is not due to the fostering care of a Goldsmiths' Hall. The silversmiths on the other side of the Atlantic being more practical than sentimental, dispense with such antiquated luxuries; in fact, they look upon perfect freedom of action as essential to the prosperity of their trade. (*Vide* the opinion of the largest silver manufacturing concern in the States as expressed in a letter to Sir Henry Jackson, Bart. M.P., Chairman of the Select Commitee on Hall-marking; a copy of which letter will be found in another part of this journal.)

An attempt was made in one of the States, a few years ago, to impose an act modelled after our own Hall-marking laws, but the manufacturers almost in a body, protested against any such state law, on the grounds that its action would be detrimental to the best interests of the manufacturers of the State.

It is thus evident, that although the silversmith's trade has well taken root in American soil, legislation *à la Prideaux*, meets with no encouragement.

Fortunately our manufacturers in other branches of industry have come to the sensible conclusion that they must abandon old traditions and keep pace with the times by adopting the principles and methods of their successful rivals, if they do not wish to be extinguished from the commercial world. If the manufacture of silver plate is to remain a British industry the same course must be pursued, and the first step towards emancipating the trade from its present fettered state is the abolition of the oppressive duty and the hampering Hall-marking system.

How is it that we have made such remarkable progress in the furniture, glass, and tapestry trades as evinced by our magnificent shows in Paris, and recognised by the International Juries by the bestowal of Grand Prizes? We need not seek far for an answer. It is because these trades are not handicapped with burdensome taxation and the harrassing interference of a Trade Protection Society which might more appropriately be termed a Trade Prevention Society. Let us once be freed from these trammels, and the ways and means for elevating the craft and for reinstating it in its proper place among the arts, will not be long wanting.

SOCIAL SCIENCE CONGRESS AT CHELTENHAM.

A VALUABLE and interesting paper on "THE PLACE OF JEWELLERY IN ART," was read at the above Congress by E. J. Watherston, M.S.A.

Mr. Watherston has many sympathisers in his endeavours to raise the standard of our decorative arts, and to supplant our present barbaric style of jewellery by something worthier of the traditions of the craft. We must confess that the cause has met with an able advocate, and we feel sure that his services will be recognised by all those who can appreciate "a thing of beauty."

As it is our intention to reproduce the paper *in extenso* we abstain from entering into details.

CHARLES V. WOERD'S NEW MODE OF COMPENSATING BALANCES.

(As applied by the American Watch Company, Waltham.)

THE form of compensation hitherto employed in the balances of watches and chronometers can be made perfect only for two critical temperatures, and for intermediate or extreme temperatures the compensation is imperfect. Devices called secondary or auxiliary compensation have been applied to remedy this defect in a partial degree. The effect of the temperature is to modify the elastic force of the spring as well as to change its length, and to change the form of the balance; and perfect compensation requires that the time of vibration of the balance shall be constant under all the vicissitudes of temperature to which the instrument may be subjected. This requires that an arrangement of the parts shall be made such that the moment of inertia of the balance shall maintain a constant ratio to the moment of the elastic force of the balance spring. The law of the change of the effective elastic force of the spring is not certainly known; but sufficient is known in regard to it to make it certain that the compensation cannot be made perfect except at two temperatures. The expressions of the variations of these moments in respect to the temperature, give when graphically represented two curved lines, and the adjustment can be made only for the two points where these curves intersect.

My device consists in the substitution of an entirely different arrangement of bi-metallic laminæ in such way that the ratio of the moments of the balance and of the spring shall remain constant during all the temperatures to which the watch or chronometer may be subjected while in use.

First I employ for the inner laminæ steel as usual, but for the outer lamniæ I employ a composition of higher expansibility than brass hitherto used for that purpose. Instead of two parallel connected laminæ, I use only a short arc of the outer composition, and this is connected with the steel in the form of intermeshing teeth fused solidly to the steel. The outer rim is turned down so that the fine edge of the steel teeth separate the composition into a succession of prisms.

By this means the action is different from that of continuous bimetallic laminæ, in that it avoids the difficulties arising from the constrained and irregular action of the laminæ, and provides for that freedom of movement of the compensating weights which is necessary to fulfil the actual requirements of the adjustment for temperature.

Second, by means of my arrangement it is always possible to find the number of teeth in the bi-metallic part of the rim which, in connection with the proper compensating weights, will make the motion of these weights correspond with the requirements of the balance spring for tautochronous vibrations at different temperatures. In order to lighten the steel rim and keep the effective weight of the balance as near the extremities of the segments as possible, I drill one or more holes in this steel rim and intermediate between the bi-metallic part and the compensating weights, so that the desired effect may be produced by a limited arc of the two metals. This provides also for a delicate adjustment of the poise of the balance.

NEW KEYLESS MOVEMENT.

MR. THOMAS WALLEN, of King Street, Coventry, has invented and patented an improved keyless movement, remarkable for simplicity and time-keeping qualities. It is manufactured in all grades, and well worthy the attention of the trade.

In a future issue we shall give a detailed and illustrated description of this valuable patent.

JEWELLERY.

By George Wallis.

(Continued from page 45.)

THE traditional jewellery of Europe is best illustrated in what has been called the "peasant jewellery" of the various Continental nations. These vary considerably in different localities as regards the general forms of the ornaments themselves and the character of the details, but the most ancient and genuine examples appear to be all based upon one simple mode of production, that of a thin plate of gold or silver in which the design is executed by perforations, delicate repoussé work, and the setting of stones, either real or imitation.

The custom of the ornaments of the women of one generation descending to their daughters in the next, and being handed down in families from age to age, is altogether so contrary to the modern notions of change of fashion within short periods of time that we see at once the old and new systems are diametrically opposed to each other, and as the influence of modern change is wide-spread and inevitable, the preservation of specimens of the jewellery of the common people of the various countries, not only of Europe, but of the world, has been a subject which has engaged much attention since 1867, when Signor Castellani, of Rome, brought his famous collection of Italian peasant jewellery before the public in the Paris International Exhibition. This collection is now in the South Kensington Museum, classified to illustrate the various provinces of Italy; and large additions have been made during the last two or three years of specimens of French (chiefly from Normandy), Spain, various parts of Germany, Denmark, Holland, Switzerland, and finally of the common decorations and trinkets worn by the people of India.

The study of the historic styles of ornament, as applied to objects of personal decoration, together with those before quoted, as open to the student in a national museum, is of the greatest importance to the success, not only of the designer but the workman. Former methods of treatment, combinations of effect, and even, in some degree, of manipulation itself, may be suggested by the careful and intelligent examination of what has been done in the past; not so much, however, for the purposes of imitation, as to suggest a unity in the conditions of all good designs, viz.: adaptation of the object to use, the nature of the materials employed, and the handicraft, or mechanical methods, by which the design is to be realized.

Thus far I have been dealing very briefly with the production of jewellery in the various ages and countries of the world as an art, and not as a manufacture or industry, into which a systematic division of labour enters, for the purpose of economy, or on which modern science, in the application of mechanical and chemical means, has been brought to bear, to meet the extended and constantly extending wants of modern civilization.

With the increase of wealth, the extension of commerce, the growth of luxury, and let us hope, too, an advance in refinement, and a love of art, new wants have arisen as springing out of the old ones. These wants may take new forms, and manifest themselves when met, in new fashions; but the original sentiment is the same, and the personal decorations and jewelled adjuncts to dress of our day, stand in the same relation to the love of embellishment and ornamentation inherent in man, as it did thousands of years ago.

It is impossible to give any precise date at which the production of jewellery in its modern form commenced in Britain. It may be safely assumed that the Huguenot colony, which settled in Clerkenwell after the revocation of the edict of Nantes, although reputed to have been chiefly watchmakers, were also producers of objects used for personal decoration. In the early and middle portion of the last century, the production of silver buckles, which formed such convenient adjuncts to the dress of the ladies and gentlemen of the period, was carried on in Clerkenwell; and there is good authority for stating that ornamental steel work, which proved so very important an item of industry at Wolverhampton, was also carried on at Clerkenwell; and that a trade intercourse existed between Clerkenwell as the metropolitan centre of manufacture of personal ornaments, and the provincial sources of production, Birmingham and Wolverhampton. One of the most eminent steel workers of Wolverhampton in the last century, a relative of my own, an aged man when I was a boy, told me that he commenced his industrial career in Clerkenwell about 1770, with his uncle, who was a silver buckle maker to the Court, and that from about 1780 to 1792, he had himself supplied large quantities of steel ornaments to the Courts of England, France and Spain.

The latter town was famous for the character of its artistic productions in steel, which found a ready market in London and on the continent of Europe. These works consisted of chains, chatelaines, buttons, buckles, clasps, &c. They were frequently embellished with the fine cameo-like productions of Wedgwood, in blue and white jasper, or painted enamels executed at Battersea and Balston, the latter being of a common character. Some of the more beautiful enamels were, however, imported from Paris, and sent back set in exquisite mounts of steel. Sword hilts too were produced in considerable numbers at Wolverhampton. This industry came practically to an end at the period of the first French revolution. It lingered in a very attenuated form for many years, but finally died out with the skilled workers who had at one period carried it on to their own profit and the national credit.

At Birmingham, the now famous workshops of Boulton and Watt, of Soho, as also many smaller manufactories, produced considerable quantities of articles not only in steel, which seems to have been a speciality of Wolverhampton, but in gold and silver.

The production of a special kind of jewellery was also carried on at Derby. These consisted in neatly designed pins, studs, brooches, and rings of a peculiar style of setting, still known among the seniors of the jewellery trade as the "Derby style." Birmingham and Clerkenwell appear to have finally divided the trade between them so far as any organization or aggregation of industry was concerned, and in all probability this arose out of the skilled buckle makers gradually adapting themselves to changes of fashion, the new generation of workers seeking to rival the productions of foreign jewellers, or imitate those productions when brought under their notice by the merchants whose business it was to supply the demands of distant markets.

Lapidaries to cut the stones, real or imitation, with which the buckles and buttons are frequently set; engravers, enamellers, and chasers to embellish the metal itself; solderers to put the parts together, were so many skilled workers, ready trained to the use of their eyes and fingers, and therefore as a necessity arose out of a change of fashion prepared to adapt themselves to new demands upon their skill. In addition to the buckle and button makers there were the makers of watch keys and seals, the latter certainly requiring the assistance of the engraver in the execution of the devices of various degrees of intricacy. Intaglio heads sunk in steel were not uncommon in work executed at Birmingham in the last century.

(To be continued.)

ILLUMINATING TURRET CLOCKS.

HERR REINIGER, of Stuttgart, suggests that small towns may secure to themselves all the advantages of an illuminated tower clock, at but trifling expense, by employing the magic lantern to throw the image of a clock face and hands, highly magnified, upon a properly prepared surface, located in a conspicuous place.

TRADE RECIPES, &c.

To Gild Watch Movements.—For old work, it must be prepared by first scouring off all the remains of the old gilding with ground pumice stone, a stiff brush, and water; after washing clean, the surface must be matted to give it the rough granular appearance of fire gilding. This is done by leaving it in the following solution while you can slowly count five.

1 oz. pure nitric acid.
¼ oz. sulphuric acid.
3 dwts. rock salt.

Dissolve the salt in the sulphuric acid, then add the nitric acid slowly. The articles must then be thoroughly washed in clean water. The following gold solution is to be employed:—

1 quart rain water
3 dwts. dentist foil (pure gold).
6 grs. pure copper (watch dial).
1½ oz. cyanuret of potash.

The solution is prepared as follows:—Dissolve the gold in ½ oz. of nitro-muriatic acid (2 parts hydrochloric, 1 part nitric). After the gold is dissolved, add the copper; leave the solution to stand on a warm sand bath till evaporated to a thickish red liquid. (The cholride of gold of commerce will not do, because it deposits the gold in a greenish colour, which is not desirable.) Then add the cyanuret of potash to the water, and add the dissolved gold.

A convenient way for gilding the articles is to take a strip of clean zinc, say an inch in width, drill half-a-dozen or more holes in the lower edge, and attach in these holes fine copper wire, which can be left permanently attached for convenience. Then twist a wire around each little piece to be gilded, in such a manner as to make a perfect connection, and yet not interfere with the proper gilding of the part of the movement to be seen. After all are attached which you wish to gild at once, immerse them in the gold solution, allowing the zinc to dip into it from ⅛ to ½ an inch, depending on the total surface of the articles to be gilded. The amount of zinc surface exposed to the action of the solution determines the quantity of electric current induced (in this matter practice must be your guide); leave in the solution from five to eight minutes, as your judgment and experience dictate.

In gilding wheels, the pinions need not be removed (they must not be put in the "matting" solution), as the gold that attaches to the polished steel work can be easily removed. After the necessary handling, previous to gilding, it is well to rinse off the articles in alcohol to remove any impurity that may have attached to them. A chemically clean surface is desirable to render the deposits of gold perfect and uniform. Finish with fine scratch-brush and soap suds, or slippery-elm water. By this method the articles will have the appearance of new work, but is essential that the materials employed should be pure otherwise the results would not be satisfactory.

Re-silvering Quadrant Glass.—The reflecting glasses of quadrants can be re-silvered as follows:—Place a piece of tin foil on a perfectly flat piece of board and pour on it a small quantity of as pure mercury as you can get. Then rub the mercury on to the tin foil with a suitable brush, and it soon unites itself with the tin. The glass, which must have been cleaned previously, is then cautiously slid upon the tin leaf in such a manner as to sweep off the redundant mercury which is not incorporated with the tin. A weight is then placed on the glass, and in a little time the quick-silvered tin foil adheres so firmly to the glass that the weight may be removed without any danger of its falling off. The success of the operation depends much on the cleanliness of the glass, as the least dirt on its surface will prevent the adhesion of the quick-silvered tin foil.

Mordants for Metals.—One of the best mordants for steel is recommended as follows: One part fuming nitric acid; 5 parts acetic acid. Mix gently. This mordant will act as powerfully in half a minute on steel as ordinary nitric acid in ten. For weak tints, and when more care and time are required, the preparation must be mixed with distilled water. An excellent copper mordant is, according to Dr. Boettger, the following: 10 parts fuming hydrochloric acid; 70 parts of water, to which a solution of 2 parts of chlorous acid is added in 20 parts of water. From 100 to 200 parts of water must be added for very fine work. An excellent mordant for copper, brass, and German silver is the following: Ten grammes of chlorous acid, dissolved by boiling in 100 grammes of water, to which after cooling is added 75 grammes of raw hydrochloric acid, and 200 grammes of water. For a deep mordant for zinc, copper, brass, and steel there can be nothing better, according to J. J. Hess, than chromic acid, which must be diluted according to the purpose intended. By this process the nitric acid vapours are avoided and the etching process is easily controlled. The etched places are shown well cut and perpendicular. Pure nitric acid, with an adjunct of a little sulphate of copper, is specially adapted for copper and brass, or the following: Two parts of water; one part of fuming nitric acid. For silver, pure nitric acid.—*Der Metallarbeiter.*

Preparation of Pure Zinc.—Common zinc is dissolved in hydrochloric acid; sulphuretted hydrogen is passed through the solution, which is then filtered. Iron is then oxidized with nitric acid and precipitated with ammonia, so that a part of the zinc remains with the precipitate. After allowing it to rest for 24 hours filter, boil to dryness, and melt the chloride of zinc which is then reduced mixed with chloride of sodium by sodium.—*Tresenius' Zeitschriften.*

Oxydising Silver.—Dr. Ellsner, in *Chem. Techn. Mittheilungen*, says that there are two distinct shades in use, one produced by chloride, which has a brownish tint, and the other by sulphur which has a bluish black tint. To produce the former, it is only necessary to wash the article with a solution of sal-ammoniac; a much more beautiful tint may, however, be obtained by employing a solution composed of equal parts of sulphate of copper and sal-ammoniac in vinegar. The fine black tint may be produced by a slightly warm solution of sulphuret of potassium or sodium.

Bismuth Bronze.—A bronze which withstands oxydation and which is particularly suitable for the preparation of metal and lamp reflectors is made of the following:

Copper	52	parts
Nickel	30	,,
Zinc	12	,,
Lead	5	,,
Bismuth	1	,,

Berg und Huttenindustrie Zeitung.

Green Varnish for Metal Articles.—A green varnish for metal articles may be thus prepared. Put as much red arsenic or mastic into a strong potash lye as will be dissolved by it, then dilute the solution with water, and add a salt of copper (vitriol or acetate of copper). The green precipitate should be washed, dried, and dissolved in oil of turpentine. Unfortunately, mastic is too dear for the varnish to be used for all purposes.—*Industrie Blaetter.*

Hardening of Copper and its Alloys.—Everitt gives the following recipe: melt together and stir until thoroughly incorporated, copper and from one to six per cent. of oxide of manganese. The other ingredients for bronze or other alloys may then be added. The copper becomes homogeneous, harder and tougher.

Musée des Arts Decoratifs.—A Museum of decorative art was opened in Paris on the 19th of September last, modelled on the South Kensington Museum. The institution was founded by private subscription, and its temporary quarters are in a wing of the Tuileries.

JOHANN MANNHART.

GERMANY has lost one of its ablest and most devoted horologists in the person of Johnan Mannhart, who died at Munich, on the 25th of August last.

The career of Mannhart, who had gained a world-wide reputation, offers much that is instructive, and we feel sure that the short biography which we translate from our able German contemporary the *Deutsche Uhrmacher Zeitung*, will be read with interest.

Johann Mannhart was born August the 31st, 1798, at Buerstling, a small village in Bavaria. When only five years of age he lost his father, a master carpenter, who fell a victim to excessive drinking. As might be expected, he left his family in destitution, and it required all the mother's time and labour to supply the physical wants of her four children, leaving her no leisure or means for their education. The tools, which the father's workshop contained, were locked up in a room to preserve them for the sons, who, when old enough, were intended to follow the same calling.

The boys were, however, not content to wait, but made a forcible entry by the window, fetched the tools out one by one and the use of them was their greatest delight. At the age of ten, Mannhart was sent to a maternal relation, a farmer near Warngau, and from there he first visited school, but returned ere long to his native village to become a cowherd on the Bavarian Alps. The carpenter's tools, which were his constant companions he dragged also with him to the Alps, and when cows and goats did not require his attention, he was constantly using them. He repaired and improved his mountain hut, built a shed for the goats, made clogs &c.; and when winter compelled him to return again to the valley, he constructed all sorts of implements for the two farmers that employed him in turn. It is certain that Mannhart would have become an expert carpenter, like his elder brother Francis, had he been destined to continue the use of the axe; but a visit to the shop of Deisenrieder, watchmaker of Gmund, in company with the groom of a neighbouring farmer and the fortunate possessor of a silver watch, resulted in a complete change in the plans and prospects of Mannhart. He had never before been in a mechanical workshop and the sight of so many fine tools made the cowherd's eyes sparkle. The watchmaker could not help noticing the lively interest the boy evinced in his workshop appliances; he kindly offered to gratify him by a more minute inspection, and when alone with the boy he asked him if he would like to become a watchmaker. "I should like it very much," replied the boy, without hesitation, "but we cannot afford to pay a premium." Deisenrieder was willing to forego the premium by prolonging the apprenticeship, and Mannhart returned to his home with what were, to his mind, the most joyful tidings. To judge from the manner with which his guardians received his news, it appears that they did not view the matter in the same light and the youthful hopes of Mannhart met with no encouragement. His godfather dismissed him with an "I don't care what you learn," and his mother told him with equal tenderness that for all she cared he could go to the d——. He went, however, without further delay to his fresh master, and devoted himself with zeal to his new sphere of labour, using not only his hands but also his head; he was not satisfied with the mere imitation of mechanical movements and processes, but from the very beginning he set his brain at work to fathom the why and the wherefore of every action. Deisenrieder, assisted by his apprentice, repaired the church clock of Gmund, and Mannhart was charged with the winding up of the same for four years. This clock was his favourite object of study, and he sat often in the church-tower, gazing intently at the wheelwork, while mentally constructing some bold mechanism of his own. At the bench, while diligently pursuing his task, he turned his projects over again; and although many of his schemes may have been illusory it is nevertheless true that this youthful genius, who knew but little of what others had thought and created before him, laid the basis to a most extensive knowledge during his apprenticeship, by his own force of study and the energy of his will. His plans for improving the church clock of Gmund did not meet with the approval of Deisenrieder, who would never believe that an apprentice could understand these matters better than the experienced master, and they often quarrelled over the subject.

In 1821, after eight years apprenticeship, Mannhart parted from Deisenrieder with an empty pocket and without knowing exactly whither to go next; but still he stepped into the world with a light heart. The clock, such as he had planned it in all its details during his apprenticeship, absorbed all his thoughts, and its construction appeared to him his first object in life. Being known as a reliable and clever workman, he did not remain idle long, but found employment as overseer at a clock factory in Miesbach, in which also the heavier class of clockwork was manufactured. This establishment, having lost its permanent head, was not in a flourishing condition when Mannhart undertook its management; there had been much neglect and the business had consequently fallen off, so that it devolved on him to create order and to bring life into it again. The position was, however, quite in harmony with Mannhart's inclinations, as it enabled him to put many of his ideas into practice. The workshop was fitted up with tools and appliances of his own construction, and he turned the work out in such a creditable manner that he soon attracted considerable business.

Here he already displayed his almost universal mechanical genius, and although fully engaged with clockmaking, he still found time to construct a variety of other mechanical contrivances, to which, even when destined for the simplest of purposes, he always imparted some novel feature, as he hated to walk in old tracts when he could see more practical ones ahead. Mannhart's skill soon became known in the neighbourhood, and when the Commune of Egern decided on the acquisition of a church-clock he was entrusted with its construction. It is hardly necessary to say that he was delighted with an opportunity, which allowed him to give life to his darling project. He set to work with eagerness, and in a very short time produced a perfect master-piece, with an escapement entirely different from those hitherto in use.

Another incident occurred about the same time, which was the means of making Mannhart's talents known in more influential circles. Herr von Miller, Comptroller-General of Taxes, of Munich, who had come to Miesbach to pass his holidays, lost a part of his perspective, and was about sending a messenger to the Bavarian capital for a new one, when the messenger remarked that such a journey would be useless, as there was a clockmaker in the place who would be able to make the missing article. The director smiled, and said that more knowledge was required for such work than a village clockmaker was likely to possess. The man, on the contrary, felt sure that Mannhart was competent to do the work, and was not satisfied till the perspective was handed to him with permission to take it to his village genius. When the instrument was brought back, Herr von Miller was no little astonished to find that the part replaced by Mannhart surpassed all the rest in workmanship, and was so pleased that he paid considerably more than the amount claimed for the repair. He then saw Mannhart at his workshop, and from the work displayed there he soon discovered that he had to deal here with a man of no ordinary gifts. Mannhart afterwards often visited at the director's house, made and repaired a number of articles for him, and quite charmed the whole family with his astonishing aptitude at everything he laid his hand to.

Herr von Miller returned to Munich, but he did not forget his *protégé*. It was by that gentleman's recommendation that the clock which Mannhart constructed for Egern was brought to the capital in the summer of 1826, and exhibited in the town hall. A commission of competent judges was appointed to examine the clock, and their report was very favourable. It is stated that the clock was a perfect masterpiece of horological skill, offering many advantages (which were all specified); that its construction was quite distinct from ordinary turret-clocks and that it may be considered as a new invention. It also acknowledged the fine execution and careful finish, and recommended Mannhart as deserving of assistance and encouragement. The clock went back to Egern, where it does excellent service to this day. The examiners showed their appreciation of his talents by inviting him to settle permanently in Munich, a proposal which he gladly accepted. He married shortly after his arrival in that city and opened a small workshop; but the first few years' business did not turn out so bright as Mannhart anticipated, and for six years he had not a single turret clock to make. As may be expected from a man to whom study and work was an absolute necessity, he did not remain idle, but occupied himself with such work as was at hand. In 1833 he received, however, an order to construct a clock for the new Protestant Church in Munich, and this work he executed on the principle of the Egern one, but on a larger scale. Orders for three other clocks came in succession, keeping him fully employed till 1837. His reputation had gradually spread further, and King Louis I. of Bavaria presented him in July 1, 1838, with the Medal of Merit, in recognition of his services to mechanics.

From this epoch dates Mannhart's extraordinary activity in all branches of mechanics, and it would require pages to give only an outline of his numerous undertakings, improvements, and inventions. In 1844 he became proprietor of a tool and machine factory in Munich, where he employed 44 workmen, a number which had increased to 116 in 1861. In spite of his manifold engagements outside the province of horology, he never forgot his favourite object in life, the construction and improvement of turret clocks. In 1842 he made a clock for the Cathedral of Munich, a clock which from two towers and on six dials supplies the standard time to the whole of that pleasant city. This excellent piece of mechanism secured him a large number of other orders, and he supplied clocks for the tower at Winterthur (Switzerland), for the railway stations at Zurich, Nurnberg, Augsburg, and Munich.

To keep pace with the progress which horological art was making in other countries, Mannhart travelled all over Germany, France, England, Ireland, and Scotland. Wherever he went he examined the most important turret clocks, and on his return he applied the fruits of his careful study in his own establishment. His turret-clocks gained an almost world-wide reputation, and he sent numbers of them to all parts of Germany, Switzerland, Austria, Bohemia, Hungary, Italy, Greece, &c.; also to Russia, Holland, England, Ireland, North and South America, Mexico, the West Indies, and even to the Cape of Good Hope.

At all the exhibitions in Germany and Austria, as well as in Paris and London, his clocks were awarded first prizes. In 1867, Mannhart was elected a member of the National Academy of Agriculture, and was awarded a gold medal of the first class. The London Society for the Encouragement of Art and Industry granted him a medal of the first class, with diploma; and the same society had previously honoured him with the title and diploma of an honorary vice-president. On the recommendation of King Louis I. he received a bonus of about £500 from the Bavarian government. He went to Rome in 1865, where already some of his clocks had found their way, and was requested by Pius IX. to put up a clock in the Vatican. In the same year he was also entrusted with the construction of the clock for the new town-hall in Berlin, a remarkable and unique piece of clock-work. Of special importance is Mannhart's invention of the clock with "free-swinging" pendulum—a problem which had already occupied the minds of Galileo in 1584 and Huyghens in 1657. His Egern clock was already based on this principle, but in 1862 he applied the system to a clock which, without oil and friction, kept, and still keeps, excellent time. This invention was rewarded with honours from various scientific societies. In 1868 he improved and simplified the system, and applied it first to an eight-day turret-clock, which worked under all temperatures with an accuracy hitherto unattained by this kind of time-machines.

Mannhart's clocks at the Vienna Exhibition of 1873 met with the admiration of all clockmakers; and the jury accorded him the highest prize, the Medal for Progress. To give some idea of the extent of his trade we may state that he manufactured over 1,300 turret-clocks, and that the produce of his workshops in the various branches amounted to millions of florins.

Mannhart's career was, however, not one continued success; on the contrary, he suffered many severe reverses. In his later years he lost much of what he had earned by his never-flagging industry, and, sadder still, death robbed him of his faithful wife and his only son. But even such serious calamities as these were unable to damp his energy and love for his art; if the world frowned he buried himself in his workshop, and there, among his instruments and works of his creation, he forgot the world. We may add that shortly before his death he contemplated applying the American system of watch-making to the turret-clock manufacture.

HALL MARKING IN AMERICA.

We have been requested to publish the following letter which has been addressed to Sir Henry Jackson, M.P., the chairman of the Select Committee upon Hall Marking.

New York, October 2, 1878.

Sir,—It has been reported to us that an American gentleman, giving evidence before the Select Committee of which you are chairman, has placed upon record his opinion that American manufacturers would greatly prefer to have a system of compulsory hall marking adopted in their country in imitation of that prevailing in England.

Permit us, as the largest manufacturers of silver plate in America, to express our conviction that the English system of compulsory hall marking would be most detrimental to our interests.

Nothing can be further from our desire than to have Government interference with our manufacture.

We guarantee our wares to be absolutely of the standard of $\frac{925}{1000}$ pure silver. So well is this fact understood that whereever our sterling silver ware is offered for sale, no question is raised as to the purity of the metal.

The success which has attended the exhibit of a well-known American firm at the Paris Exposition is, in a measure, attributable to the absolute freedom from Government control which happily prevails upon this side of the Atlantic.—We have the honour to be, sir,

Your obedient servants,
(Signed.) Gorham, Mfg. Co.
Gorham Thurber, *Treasurer.*

To Sir Henry Jackson,
Baronet, Q.C., M.P.

Poncis Battery.—This new cell, the invention of an Italian professor, consists of a glass jar and porous pot, the former containing a solution of ferric chloride, in which is immersed a carbon plate, and the latter containing a solution of ferrous chloride in which is immersed an iron plate. Both solutions should be made to a strength of 35° of Baume's scale. The electro-motive force of an element is about $\frac{9}{10}$ of a Daniell.

CURIOSITIES OF CLOCKS AND WATCHES.

(Continued from page 50.)

HE further adds these words:—"I will do one thing more which London shall not show the like; I will make two hands show the hours and minutes without the church, upon a double dial, which will be worth your observation, and to my credit." It appears that the vestry agreed to give to Harrys the sum of £35 and the old clock for as much of his plan as they thought proper to adopt; and on October 28th in the same year, 1671, his task being completed, he was voted £4 per annum to keep it in repair. We find that the idea of chimes was given up, as well as the dials at the east end. Originally, in 1737, this clock, with its large gilt dial, was within a square, ornamented case, with a semi-circular pediment; and the tube from the church to the dial was supported by a carved figure of Time, with expanded wings as a bracket. In 1738 it cost the parish £110 for repairs. Above it, in an alcove, and in a standing posture, were two life-size wooden figures of "savages or Hercules," as Strype describes them, or "two wooden horologists," as Ned Ward calls them, with clubs in their right hands, who struck the quarters of every hour on the two suspended bells, moving their heads at the same time. These figures much excited the interest of the passers-by, especially provincial visitors to London, who would stop in crowds to see these automata strike the quarters with their clubs. Leigh, in his "New Picture of London," calls them the pets of cockneys and countrymen—

"Many a stranger, as he passed that way,
Made it once a design there to stay
And see those two hammer the hours away
In Fleet Street."

They were one of the sights of London, and many a gazer at them has unwittingly enriched the pickpockets and cut-purses who used to mix with the crowd of gaping idlers assembled under this clock, to the no small obstruction of the foot and carriage-way. One historian tells us that they were "more admired by many of the populace on Sundays than the most eloquent preacher from the pulpit within." A writer in the *Mirror*, 1828, says, "It would be needless to describe the two brazen, striking Saracens who attract the gaping multitude; when they perform operations one would really suppose they were in league with the pickpockets, who are below striking into the pockets of their admirers *sans cérémonie.*" The author of "London Scenes and London People," an eye-witness of the old clock, says, "The giants stood in front of the building, about thirty feet from the road, on a covered platform, each wielding a club, the bell being hung between them, which at the quarters as well as whole hours they struck, but so indolently that spectators often complained that they were not well up to their work. The mechanism, too, was rough and clumsy; you could not help noticing the metal cord inserted in the club, to which its motion was due." Sir Walter Scott speaks of the savages in his "Fortunes of Nigel;" but he places them in position before they were known to the gaping cockneys. Cowper thus alludes, in his "Table Talk," to these figures—

"When labour and when dullness, club in hand,
Like two figures at St. Dunstan's stand,
Beating alternately in measured time
The clockwork, tintinnabulum of rhyme,
Exact and regular sounds will be;
But such mere quarter strokes are not for me."

In "A Pacquet from Wells; or, a New Collection of Original Letters," &c., 1701, we read, "A lady of pleasure being the escutcheon of iniquity, and the Cully and Pully, her two supporters, hanging thus like St. Dunstan's clock, between Boucher and Bowden for both to knock at in their turns." When the old church was pulled down the clock and figures were purchased by the Marquis of Hertford, and removed to his villa in Regent's Park, where the clubbers still do duty every quarter of an hour. We read under date October 22nd, 1830, "Mr. Creaton, auctioneer, sold by private contract to the Marquis of Hertford the clock tower, with its two figures, for £210."

St. Dunstan's had a clock previous to 1671. It was an overhanging one, and beneath it and in front of the church were shops inhabited by booksellers. One of the titles to the publications issued from here reads, "Celia: containing certaine Sonets. By David Murray, Scoto Britaine, at London. Printed for John Smethwicke, and are to be sold at his shop in St. Dunstan's Churchyard, in Fleet Street, *under the Diall*, 1611, 12mo." What made the "Diall" so famous was the setting up of the giants in 1671, although so early as 1478 there was a similar piece of mechanism in Fleet Street. Stow describes a conduit erected that year near Shoe Lane, with angels having "sweet sounding bells before them. Whereupon, by an engine placed in the tower, they divers hours of the day and night with hammers chimed such an hymn as was appointed." Mr. Denham tells us that "whatever St. Dunstan's clock might have been in the first instance, it is certainly not the only device of the kind extant at the present time in England. Those persons who have inspected the curiosities at the cathedral at Norwich will remember that the quarters, for the use of persons within the building, are struck by two similar, though much smaller figures, placed near two bells inside the church in one of the recesses of the south aisle, and that the arms communicate with the abbey clock by strings which are visible in their whole course from the figures to the ceiling." Old St. Paul's Cathedral, London, had automaton figures which struck the quarters on the clock bell. The old church dedicated to the Holy Trinity at Bristol, which was demolished in 1787, the new one of Christ Church occupying its site, had a tapering spire, and in the tower was a clock guarded by gigantic "quarter-boys" represented in two large figures, with ever-ready hammers to note the flight of time. They were similar to those formerly outside St. Dunstan's Church; and were placed under a semi-circular canopy on each side of the face of the clock. They wore brass helmets, and were partly habited in armour; each grasped a battle axe, with which it struck the bell suspended over its head. It would appear that they were coloured and gilt with care, according to the taste of the age. These "quarter-boys" are still preserved at Bromfield House, Brislington, in the possession of the Rev. George Weare Braikenridge.

The clock at Alderley is a very old and curious piece of mechanism. An inscription on it states that it was presented to the church of Alderley by the great Sir Matthew Hale:—"This is the guift of the Right Honourable the Lord Chief Justice Heale, to the Parish Church of Alderly. John Mason, Bristol, Fecit, Novem. 1st, 1673." It appears by this inscription to have been presented on his birthday, which from the record on his tomb was November 1st. Alderley is the family place of the Hale family to this day.

During the seventeenth century there was a great taste for striking clocks, which were to be had in every variety of form. Several of them, made by Thomas Tompion, who invented many useful things in clockwork, not only struck the quarters on eight bells, but also the hour after each quarter. At twelve o'clock forty-four blows were struck, and one hundred and thirteen between twelve and one o'clock. Failures in the striking mechanism of these clocks were attended with much annoyance to the owners of them; for they would go on striking without cessation until the weight or spring had gone down, and they were frequently contrived to go for a month. A clock made by Tompion on this construction caused much annoyance to the Duchess of Gloucester soon after her marriage. This machine was fixed in an apartment adjoining her bedchamber; the failure took place at two o'clock in the morning, and as the case could not be opened, the clock continued to strike until eight o'clock.

(To be continued.)

BRONZES.

By C. D. E. Fortnum, F.S.A.

Continued from page 49.

ABOUT the period of Augustus and subsequently, zinc is found in the imperial coinage. During the lower empire silver, varying from one to eight per cent., is also found. The general result of other analyses of several examples of Greek and Roman bronze has shown a composition of eighty-eight or ninety parts of copper to twelve or ten of tin, some specimens yielding a very small and probably accidental quantity of silver.

According to Pliny, who owns the inferiority of the Roman bronze of his time, the metal used for statues was composed of a mixture of old and new copper melted together, to every hundred parts by weight adding twelve and a half of another mixture made of equal parts of lead and tin, and the whole fused. The addition of lead would probably be to increase the fusibility of the mixture, and as an economical substitute for the full proportion of tin. It would seem to have been an acknowledged adulteration of the tin received from Spain.

Pliny and other classic authors describe also various kinds of bronze used by the ancient sculptors and founders, for the origin of some of which curious histories are given, particularly that of the Corinthian metal. The base gold, known as Corinthian metal at that time, from which vessels for the table, etc., were made, could have no relation with bronze, except, perhaps, agreement in colour with the Grecian statues, called Corinthian by the Roman dilettanti.

This *Aes Corinthiacum*, stated to have been accidentally formed during the burning of Corinth by Lucius Mummius, B.C. 146, by the fusion together of various metals, chiefly bronze, but intermingled with silver and gold, was in all likelihood a well-proportioned mixture of good metal used by the sculptors and bronzists of that city in days anterior to the period of the conflagration. This supposition is, moreover, borne out by the fact that some of the works stated by the ancient writers to have been formed of this bronze were executed long previous to the second century before Christ. The common history of the much prized Corinthian bronze must therefore be little more than mythical, and perhaps the so-called golden colour may have been only that which is now seen upon the uncorroded surfaces of some of the Greek bronzes in the British and other Museums; among others upon the justly celebrated bronzes of Siris, the analysis of which corresponded with that of a Greek helmet, with nails from the treasury of Atreus, and with some early Corinthian coins—viz.: 88 parts of copper and 12 of tin.

Again, the fact that Pliny specifies three distinct varieties of the Corinthian bronze would prove that they were purposely produced, and not the accidental result of a promiscuous fusion. He mentions the white (*candidum*), from the large quantity of silver in its composition; the golden from the admixture of that metal (a doubtful statement), and thus formed of equal portions of the several metals. But in all this the Roman naturalist merely displays his want of acute knowledge of the true nature of the *Aes Corinthiacum*, which may probably have been kept secret by the metallurgists of the Isthmian city. Other varieties of this bronze are alluded to by Pliny, as the *Aes nigrum*, etc.

The *hepatizon* was another variety of bronze much esteemed by the ancients for the rich liver colour which it took. This, in all probability, was entirely free from any admixture of zinc, and perhaps contained a somewhat smaller proportion of tin than the Corinthian. In colour and in other respects it probably assimilated to the fine rich bronze used by the Florentine artists of the fifteenth and sixteenth centuries. In the estimation of the ancients this mixture would seem to have taken an intermediate place between the Delian and Aegintean and the richer Corinthian bronze. But the *hepatizon* could only have obtained its liver colour on the surface, and was probably the result of a "pickle," the composition of which was known only to the bronzists, who mystified inquirers by ascribing it to the action of the furnace alone.

It is also highly probable that the golden variety may have been formed by the admixture of more or less of the mineral calamine, (the native carbonate of zinc), known to the ancients as imparting a golden colour when fused with copper. Of this mineral, the *cardmia* of Pliny's day, we shall speak further when treating of zinc and brass. Delos was, in the early time noted for the *Aes Deliacum*, produced by the skilful metallists of that island, to which artists and those requiring work in bronze flocked from all countries.

Myron was the great patron of the Delian alloy, which has been supposed to be of too high a tone of colour.

The bronze made at Aegina rivalled that of Delos, and was adopted by Polycleitus for his works in metal. A great number of able artists and founders seem to have carried on the work upon that island. Whatever may have been the original colour of these several varieties, the oxidising action of the atmosphere must soon have changed the glittering metal into a coloured coating, which also varied with the composition of the metal and the nature of the atmosphere to which it was exposed.

The composition of the bronze in use during the Byzantine period, as also by various artists of the *Renaissance* in Italy, Germany, and elsewhere, doubtless varied considerably, as may be noticed from the colour of the metal in their different works. We know also from Cellini's vivid description of the casting of the Perseus, how almost anything that would melt was cast into the caldron to make up for the loss of tin by the insufficiency of the fire to liquefy the mass. That the use of zinc increased is also proved by the writings of Theophilus, in the eleventh century. He moreover defines brass as *aes* or *aurichalcum*, and tells us how to mix grained copper with calamine in the crucible, which on fusion yields *aes;* but that if the *aes* is to be gilded it must be made from fine copper purified from lead: this yields the *aurichalcum*, whereas from the unrefined copper, the more ordinary *aes* is made, which will not take the gold. He also informs us that both silver and pure copper are easier to gild than *aurichalcum*. We may thus account for the frequent use of copper in making the richly gilt monstrances reliquaries, and other church vessels, and objects of the twelfth, thirteenth, and fourteenth centuries.

The bronze used in many of the works of the earlier period of the *Renaissance* varies considerably, but it is for the most part of good quality, there being no disposition on the part of the artists, who were so commonly their own founders, to cheapen the metal by admixture of an inferior alloy, and thereby to injure the rich surface effect of their castings. The works executed by Donatello, Verrochio, Pollaiuolo, by Riccio, and the Lombardi are all of rich metal. So also are the admirable casts in bronze (five of which were unfortunately melted down by order of the revolutionary government of France) made by Primaticcio, from the then most celebrated statues of antiquity, by order of Francis I., and which now adorn the gardens of the Tuileries. The addition of lead and zinc was only in small quantity; and even later we find that the Brothers Keller, who executed numerous works in bronze for Louis XIV., at Versailles, and elsewhere, were extremely careful as to the composition of their metal, which was also of fine quality.

(*To be continued.*)

Prices Current for Gold and Silver.—Value Given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver 4s. 6½d. to 4s. 9d. (variable according to quantity).

FURTHER AWARDS AT THE PARIS EXHIBITION TO BRITISH EXHIBITORS.

GOLD MEDALS have been awarded to:—

John Brogden, London, for jewellery.
Elkington and Co., Birmingham, art metal-work.
Elkington and Co's artist Morel-Ladeuil, art metal-work.
S. Chatwood, Bolton and London, safes.
Hobbs, Hart and Co., London, jewel cases, locks, &c.

SILVER MEDALS to:—

James Aitchison, Edinburgh, jewellery.
MacKay, Cunningham and Co., Edinburgh, jewellery,
W. Marshall and Co., Edinburgh, jewellery.
Francati and Santamaria, London, jet goods.
Watson and Son, London and Bombay, Indian gold and silver jewellery.
Elkington and Co's. artist, Auguste Willms, art metal work.
J. Hardman and Co., Birmingham, silver-work.
Chadburn and Son, Liverpool, optical instruments.
M. Pillischer, London, optical instruments.
W. D. Houghton, Warrington, steel wire.
W. D. Houghton, Warrington, steel wires and ropes.
Chubb and Sons, London, safes.
Sicker Safe and Strong Room Company, Birmingham, safes.

BRONZE MEDALS to:—

W. Gibson, Belfast, jewellery.
W. Hick, Huddersfield, solitaires.
W. A. Crouch, London, brooches and Highland ornaments.
J. M. Crouch, London, Scotch jewellery.
R. Hodd and Son, London, electro-plate and gilt goods.
Shaw and Fisher, Sheffield, electro-plate.
W. D. Houghton, Warrington, watch and clock wires.
E. Celti and Co., London, barometers, thermometers, &c.
Dollond and Co., London, microscopes.
Newton and Co., London, optical instruments.
E. Wheeler, London, microscopic objects.

HONOURABLE MENTION to:—

James Aitchison, Edinburgh, jewellery.
Levetus Bros., Birmingham, gilt alberts.
Levetus Bros., Birmingham, plated jewellery.
John Neal, and Co., London, pyro-silver and ware.
John Neal, London, jewellery.
F. Sage, London, show cases.

In the list of horological awards published in our last, we forgot to mention that a bronze medal was granted to F. Shick, London, for watches, and clocks.

AWARDS TO AMERICAN EXHIBITORS.

Tiffany and Co., New York.
    Grand Prize for art silverwork.
    Gold Medal, to collaborator, in same class.
    Silver Medal to collaborator, in same class.
    Bronze Medals (2) to collaborators, in same class.
    Honourable Mentions (2) to collaborators, in same class.
    Gold Medal for jewellery.
American Watch Company, Waltham, gold medal for watches.
Seth, Thomas, Clock Company, New York, silver medal, for clocks.
Ansonia Clock Company, Ansonia, bronze medal for clocks.
Hagstoz and Thorpe, Philadelphia, bronze medal for stiffened watch cases.
F. Kroeber, New York, honourable mention for clocks.
Leroy W. Fairchild, New York, gold medal for gold pens and pencil-cases.
Aikin, Lambert and Co., New York, silver medal for gold pens and pencil-cases.
Thomas Oakley, Paris, bronze medal for goldsmiths' work.
H. Muhr's Sons, Philadelphia, honourable mention for jewellery.

QUERIES AND ANSWERS.

WATCHMAKER would feel obliged to any fellow-craftsman who could tell him, through the medium of these pages, how to construct zinc rods for compensating pendulums.

D. G. H.—Presuming that your operations are on a small scale only, we recommend you the use of the Smee battery, which is simple, expedient, and inexpensive. It consists of a narrow, cylindrical glass or stoneware jar, holding about two quarts, two amalgamated zinc plates and a platinized silver plate. The whole are suspended by a cross bar of wood; and as it is essential to the proper working of the battery that the plates be always parallel to one another, the wooden frame is generally extended round the edge of the thin silver plate. A metal clamp at the top of the wooden bar is connected with the platinized silver plate, and another with the pair of zinc plates, the positive and negative poles of the battery. The method of preparing the silver plate is given by Mr. Smee, as follows:—"The silver to be prepared for this should be of a thickness sufficient to carry the current of electricity, and should be roughened by brushing it over with a little strong nitric acid, so that a frosted appearance is obtained. It is then washed and placed in a vessel with dilute sulphuric acid, to which a few drops of nitro-muriate of platinum has been added. A porous tube is then placed into this vessel with a few drops of dilute sulphuric acid, into this tube a piece of zinc is put; contact being made between the zinc and silver, the platinum will in a few seconds be thrown down upon the silver as a black metallic powder. The operation is now completed, and the platinized silver ready for use." A simple method, which obviates the use of a battery, is thus described:—

Lay the silver between two pieces of sand-paper, and press it with a common smoothing-iron, then pull the silver out while under the pressure. The platinum solution is made very hot, and the silver dipped in it for some time, which affects the coatings. The nitro-muriate of platinum is easily prepared: take one part of nitric acid, and two parts of hydrochloric acid (muriatic acid); mix together, and add a little platinum, either as metal or sponge; keep the whole at or near a boiling heat; the metal is then dissolved, forming the solution required.

The exciting fluids consist of about 15 to 20 parts of rain-water to 1 part sulphuric acid. Those parts of the zinc plates which are not exposed to the action of the acid solution are recommended to be coated with sealing-wax or melted paraffin-wax. This serves as protection against the destructive influence of the acid, and prevents it from creeping upwards, which would be fatal to the connections. The zincs must be well amalgamated, and not touch the bottom of the cell. The connections should be regularly examined and kept free from corrosion, which would stop the passage of the current.

Small square troughs, made of gutta-percha, are often used for the Smee battery, as they suit admirably, and are not liable to break.

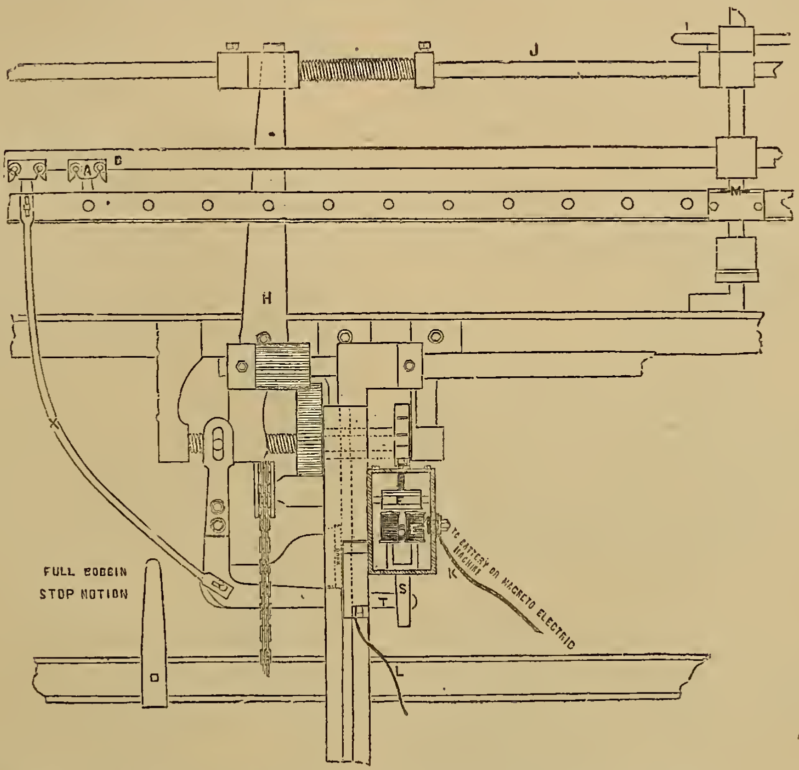
A PARURE of diamonds exhibited by Messrs. Boucheron, of Paris, and consisting of a diadem, brooch, and pendants, bracelet, ring, and earrings, has been purchased by Mrs. Mackay, wife of the fortunate Bonanza proprietor, for £34,000. The parure is profusely ornamented with blue sapphires, and terminates with a handsome pearl; the centre sapphire is valued at £4,000. The same lady has also bought another exhibit of this firm, a necklace of brilliants, terminating in a briolet drop, valued at £5,000.

THE ELECTRIC STOP-MOTION.

By W. H. Bailey.

A Paper read before the Scientific and Mechanical Society.
(Continued from page 53.)

In a notice like this it is impossible to weary the reader with too much detail. One observation will be sufficient to convince those who have at all studied the question of the advantage of using an agent like electricity, instead of mechanical agents, for effecting the above object of stopping the machines automatically when a thread breaks. When mechanical agents are applied, *motions* are required to produce the results desired; with electrical agents *contact* is sufficient.



Mechanical motions must be timed and placed so as to coincide with each other, and must be often at once delicate and strong. In this way it is often impracticable to apply the apparatus required to remedy the defects in a working machine owing to the multiplication of parts and the resulting complications becoming unmanageable. An instance of this sort is seen in the drawing frame. There there are four conspicuous defects to remedy, and yet, for fear of the complication, remedies for more than two of them are seldom ventured upon, and it is almost the exception to find these remedies in order and proper working condition.

In other cases there is an absolute bar to any mechanical motions being applied, owing to want of room for their action, and to their inaccessibility when they require, as every such motion does require from time to time, attention and adjustment. The intermediate supplies a good instance of this. The evil of "single" is admittedly great and universal, so great indeed that some spinners have elected to forego the advantages of intermediates rather than be subject to the evils of single, which their use implies. Yet no mechanical movement could at all cope with the difficulties. Indeed it was the oft-repeated failures to cure the evil by mechanical means which drove the inventors in despair to some other agent. The moment the idea of effecting the object by electricity was conceived, all serious difficulties vanished. *Contact* being all that was required in the absence of the thread of cotton, what so easy as to pass the thread between two rollers, which are thereby kept apart till the thread breaks, when contact takes place, and the machine is instantly arrested?

No wonder at the way this invention has been received by the spinners of Lancashire, when defects so serious and of such long standing can be remedied by means so simple! So simple indeed that mill-owners who have adopted the electric stop-motions hear so little of them that they are only agreeably reminded that they possess them by an absence of complaints with which they have been long familiar, but which they had become partially resigned to as necessary evils.

I have endeavoured to give you a short account of a very simple electrical contrivance, and I think what we have seen of its application this evening should enable us to congratulate the inventors on their present success. Let us hope that the engineers and electricians of this country may find still further employment for their original genius, and that present events may be so ordered, and the nation be so divinely blessed, that they will only find employment in connection with the beneficent arts of peace.

(*To be continued*).

The Cesnola Collection and Tiffany's Imitations.—The precious art treasures discovered by General di Cesnola, in the Curium of the Island of Cyprus are, as is well-known, in the possession of the Metropolitan Museum of Art, New York. Messrs. Tiffany have made them their special study and the copies they display at the Paris Exhibition are indeed triumphs of imitative goldsmith's art. We hear that General di Cesnola himself has, after a careful examination piece by piece, of the series of that which is probably the most ancient jewellery known, borne adequate testimony to the exact fidelity of the reproduction. "Were it not for your name stamped upon those you have made," writes the discoverer of the Curium of Cyprus to Messrs. Tiffany, "I believe it would be almost impossible to decide which are the originals and which the copies."

THE

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A MONTHLY TRADE JOURNAL,

Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at Milners' Buildings, Moorgate Street (Opposite Moorgate Street Station), London, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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PATENTS.

Applications for Letters Patent.

3894. Henry Payton, of the firm of Charles Payton and Sons, of Birmingham, in the county of Warwick, manufacturing jewellers, for an invention of "An improvement or improvements in fastenings for bracelets, scarf rings, finger rings, and other like articles." A communication to him from abroad by John Mendelow, of Paris, in the republic of France.—Dated 3rd October, 1878.

4007. Raphael Hunter Brandon, engineer and patent agent, of 38, Southampton Buildings, London, and 1, Rue Laffitte, Paris, for an invention of "Improvements in the mechanism and the working of electric clocks." A communication to him from Charles William Firnhaber, a person resident in Paris, Rue Laffitte, 1.—Dated 10th October, 1878.

4067. Frank Wirth, of the firm of Wirth and Company, patent solicitors, at Frankfort-on-the-Maine, in the empire of Germany, for an invention of "Improvements in calendar clocks."—A communication from Theodor Weisser, a person resident at Furtwangen, in the Grand-Duchy of Baden.—Dated 14th October, 1878.

4069. Thomas Winkles and Thomas Moxon, both of Birmingham, in the county of Warwick, for an invention of "Certain improvements in swivels for securing watches to their chains."—Dated 14th October, 1878.

4090. Thomas Wallen, of Coventry, in the county of Warwick, watch manufacturer, for an invention of "Certain improvements in keyless watches."—Dated 15th October, 1878.

Notices to Proceed.

1801. John Guy Wilson, of the city of Manchester, Mechanical Engineer and Patent Agent, has given notice at the Office of the Commissioners of his intention to proceed with his application for Letters Patent for the invention of "A new or improved billiard table detector clock."—A communication to him from abroad by Edward Pfitzner, of Breslau, in the empire of Germany.

2184. Oliver Prust Martin, of Edgbaston, in the country of Warwick, jeweller, has given the like notice in respect of the invention of "Improvements in solitaires, studs, sleeve-links and other like articles."

3132. Frank Walter Hayward, of the city of Norwich, chronometer and watch maker, has given the like notice in respect of the invention of "Improvements in watches or pocket timekeepers."

Patents Sealed.

1473. William Robert Lake, of the firm of Haseltine, Lake and Co., Patent Agents, Southampton Buildings, London, for an invention of "Improvements in watches."—A communication to him from abroad by August von Lochr of Prater-strasse, 42, Vienna, in the empire of Austria.—Dated 12th April, 1878.

1553. Edward Thomas Hughes, of the firm of Hughes and Son, Patent Agents, of 123, Chancery Lane, London, for an invention of "Improvements in clock movement."—A communication to him from abroad by Theodore Freeling-huysen Breese. of New Haven, Connecticut, United States of America.—Dated 17th April, 1878.

Grants of Provisional Protection for Six Months.

3595. Joseph Clark, of Liverpool, in the county of Lancaster, for the invention of "An improved safety fastening for studs, buttons, brooches, &c."

3601. James Witherspoon, of Fox Court, Brook Street, Holborn, in the county of Middlesex, for the invention of "Improvements in the cases or frames of barometers."

3766. Martin Lowenstein, of Birmingham, in the county of Warwick, Manufacturing Jeweller, for the invention of "Improvements in buttons, solitaires, sleeve-links, studs, &c."

3774. Thomas Casson, of Denbigh, in the county of Denbigh, Bank Manager, for the invention of "Improved means and apparatus for working clocks and bells."

3787. Alfred Burgess, of Birmingham, in the county of Warwick, Jeweller, for the invention of "Improvements in spring bracelets, scarf-slides, and other rings."

3894. Henry Payton, of the firm of Charles Payton and Sons, of Birmingham, in the county of Warwick, Manufacturing Jewellers, for the invention of "An improvement or improvements in fastenings for bracelets, scarf rings, finger rings, &c."—A communication to him from abroad by John Mendelow, of Paris, in the Republic of France.

Patents Granted in Foreign States.

FRANCE.

122,439. Baveux, for "A chronometrical indicator with clock-work."—Dated 4th February, 1878.—Class 12.

122,518. Levavasseur, of Paris, for "A chain applicable for jewellery and machinery."—Dated 8th February, 1878.—Class 17.

122, 648. Poirier, of Paris, for "An anode plate (or pole) of granular nickel."—Dated 16th February, 1878.—Class 8.

122,686. Petit, of Bourges, for "Converting striking works of clocks into alarms."—Dated 23rd February, 1878.—Class 12.

122,743. Gundlach, Bausch, and Lomb, for "Improvements in the object-glasses of microscopes."—Dated 20th February, 1878.—Class 12.

122,848. Kieffer, for "Improvements in bracelets."—Dated 26th February, 1878.—Class 17.

122,904. Levy, for "A calendar motion for clocks."—Dated 28th February, 1878.—Class 12.

122,960. Carbonneaux, of Paris, for "Jointed or rocking bottoms of studs."—Dated 2nd March, 1878.—Class 16.

123,078. Viallet, for "Improvements in studs for cuffs."—Dated 8th March, 1878.— Class 16.

123,280. Duche, for "Bracelet fastenings."—Dated 18th March, 1878.—Class 17.

123,296. Arrouit, for "A metallic barometer."—Dated 19th March, 1878.—Class 12.

123,378. Perret, for "A field watch or curve meter compass watch."—Dated 22nd March, 1878.—Class 12.

123,411. Perret, jun., for "Regulating watches by remontoirs."—Dated 23rd March, 1878.—Class 12

123,455. Freelinghuysen-Breese, for "A clockwork."—Dated 26th March, 1878.—Class 12.

CERTIFICATES OF ADDITION.

118,461. Ulmann, for "A circular remontoir for clocks.—Dated 1st February, 1878.—Class 12.

118,669. Dupre, for "A telemetric telescope."—Dated 5th February, 1878.—Class 12.

121,999. Hubert and Co., for "Improvements in bracelets, &c."—Dated 2nd February, 1878.—Class 17.

119,543. Courty, for "Nickel plating upon copper, gold, &c."—Dated 15th February, 1878.—Class 17.

107,282. Redier, for "Improvements in clock-work."—Dated 4th March, 1878.—Class 12.

120,879. Bonnafous, for "Sleeve-links."—Dated 16th March, 1878.—Class 16.

117,784. Amiet, for "A remontoir-watch."—Dated 27th March, 1878.—Class 12.

115,663. Lion, for "Bracelets."—Dated 22nd March, 1878.—Class 17.

118,245. Carollet, for "A chronometer clock."—Dated 30th March, 1878.—Class 12.

121,548. Cotte, for "A watch-case."—Dated 27th March, 1878.—Class 17.

UNITED STATES OF AMERICA.

206,306. George D. Edmondson, of Detroit, Mich., for "Frames for spectacles and eyeglasses."—Application filed 13th April, 1878.

206,411. George Ager, of Thomaston, Conn., assignor to the Seth Thomas Clock Company, of the same place, for "Clock-faces,"—Application filed 3rd July, 1878.

206,533. Leonard C. Briggs, of Boston, Mass., for "Watch-regulators."—Application filed 1st April, 1878.

206,674. Otis Hoyt, of Springfield, Ill., assignor to the Illinois Springfield Watch Company, of the same place, for "Stem winding and setting watches."—Application filed 7th February, 1878.

207,116. Pierre E. Godefroy, of Mobile, Ala., for "Eyeglasses."—Application filed 8th July, 1878.

BELGIUM.

46,149. P. Z. S. Bulot, for "Studs with movable bottom-plates and fixed fasteners for cuffs," &c.—Dated 13th September, 1878.—French Patent, 6th September, 1878.

AUSTRIA.

7. F. Beron, of Vienna, for "Bracelet-fasteners."—Dated 16th April, 1878.—Class 7.

71. C. Krauss, of Vienna, for "A contact and disengaging gear for electrical clocks."—Dated 22nd March, 1878.—Class 7.

77. A R. Lohr, of Vienna, for "Automatic apparatus for winding clocks exposed to vibratory motion."—Dated 25th March, 1878.—Class 7.

90. L. Moser, of Carlsbad, for "A process of decorating glass by means of opaque relievo enamel colours and gold."—Dated 9th March, 1878.—Class 17.

120. R. Speltz, of Frankfort-on-the-Maine, for "Fastening ear-rings."—Dated 23rd March, 1878.—Class 7.—Belgian Patent, 8th December.

14. C. Brotbeck, of Vienna, for "Improvements in calendar pendulum clocks."—Dated 22nd July, 1878.—Class 7.

64. M. Korotin, of Vienna, for "Silver-chains and their various parts, of hollow bent links."—Dated 8th May, 1878.—Class 7.

65. W. and F. Kreb, of Vienna, for "Improvements in the manufacture of their doubled silver wire."—Dated 8th May, 1878.—Class 7.

96. A. Steiner, of Vienna, for "Improvements in remontoirs for spring pendulum clocks."—Dated 3rd May, 1878.—Class 7.

GERMAN EMPIRE.

2668. A. Moser, of Aix-la-Chappelle, for "Improvements in telescopes for measuring angles."—Dated 22nd January, 1878.—Class 42.

2728. Dr. B. M. Wilkerson, of Baltimore (U.S.), for "A double-action alarm for clocks."—Dated 10th March, 1878.—Class 30.

2746. E. Gundlach and J. J. Bausch, of Rochester, and H. Lomb, of Brooklyn, for "Modifications in the object-glasses of microscopes."—Dated 19th March, 1878.—Class 42.

2782. F. Moesch, of Reudnitz, near Leipzig, for "Modifications in the motion of pendulum clocks."—Dated 8th September, 1877.—Class 83.

2811. J. E. Orry, of Paris, for "A chain for jewellery and manufacturing the same."—Dated 26th March, 1878. Class 49.

2818. T. Freelinghuysen Breese, of Newhaven, for "Modifications in the motion of watches."—Dated 13th April, 1878.—Class 83.

2855. H. De Groote, of Hanau, for "Jointed links in chains and bracelets."—Dated 12th March, 1878.—Class 44.

2888. E. Messter, of Berlin, for "Spectacles and eye-glasses."—Dated 16th March, 1878.—Class 42.

2937. C. E. Reymaud, of Paris, for "An apparatus for producing optical delusions."—Dated 17th April, 1878.—Class 42.

2960. A. Th. Goll and C. A. Schluno, of Frankfort-on-the-Maine, for "Modifications in his wrist-links and studs."—Dated 31st January, 1878.—Class 44.—Addition to Patent, No. 1998.

2971. J. Friedlander, of Charlottenburg, for "A guard for watches, portemonnaies, pocket-books, &c."—Dated 19th March, 1878.—Class 44.

2993. J. A. Sautter, of Ravensburg, for "A remontoir watch."—Dated 24th March, 1878.—Class 83.

3135. K. Schmitz, of Elberfeld, for "A contact apparatus for wheel and striking works in normal clocks for working electric clocks."—Dated 3rd May, 1878.—Class 83.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Dubberley, Sarah, Church St., Monmouth, jeweller. Sept. 26. B. H. Deakin, sol., Monmouth.

Sheraton, Jno., Blenheim St. and Clayton St., both Newcastle, jeweller. Sept. 30. Chartres, Youll, and Wilkinson, sols., 18, Grainger Street, Newcastle.

Hertzberg, Julius, 87, Englefield Road, Islington, late 43, Bishopsgate Street Without, jeweller. September 24. A. J. Murray, sol., 11, Langham Street, Portland Place.

Lepp, Jas., Rock Street, Bury, watchmaker. October 4. G. Whitehead, Son, and Dodds, sols., Bury.

Hunter, Robert, 10, Spurriergate and Waterloo Place, both York, watchmaker. October 2. G. Cumbie, sol., York.

Carpenter, Jas., Dover, watchmaker and jeweller. Oct. 4. J. Stilwell, sol.

Lecomber, John, Slater Street and Duke Street, Liverpool, watch manufacturer. October 7. Nordon and Mason, sols., 7, Victoria Street, Liverpool.

Solomon, Percy Levy, Great Hampton Street and Great Western Arcade, both Birmingham, jeweller. Oct. 11. S. N. Solomon, sol., Ann Street, Birmingham.

Matthews, Thos., Knighton, Radnor, watchmaker. Oct. 9. G. Green, sol., Knighton.

Cox, Frederick, 154 Southampton Row, Bloomsbury, jeweller. Sept. 30. S. T. Cooper, sol., 88, Chancery Lane.

Bott, Thos., trading as Thomas Bott and Co., Argyle Street, Birkenhead, jeweller. Oct. 18. Z. R. Killey. sol., 22, Lord Street, Liverpool.

Bamford, Henry White, 18, King Square, St. Luke's, gold watch-case maker, late trading as Bamford and Co., Eversholt Street, Camden Town, grocer. Oct. 21. W. B. Croft, sol., 7, Union Court, Old Broad Street, Nov. 8 at 2.

Frank, Julius, trading as J. Frank and Co., 13a, Great George Street, and Post Office Place, both Liverpool, jeweller and auctioneer. Oct. 21. T. Etty, sol., 22, Lord Street, Liverpool.

Buchman, Samuel, 12, Carthusian Street, Aldersgate Street, late Goswell Road, jeweller. Oct. 22. Goldberg and Langden, sols., 1, West Street, Finsbury Circus, Nov. 11 at 3.

Edwards, Wm., China Street, Llanidloes, watchmaker. Oct. 22. Stork Hotel, Clayton Square, Birmingham, Nov. 7 at 1. J. D. Davies, sol., Llanidloes.

Trustees Appointed.

Hare, Alfred (Liq.), Kidderminster, watchmaker. Tr., A. W. Beale, Kidderminster, accountant.

Boyall, Joseph (Liq.), Spilsby, Lincolnshire, watchmaker. Tr., F. B. Leeming, 10, Coleman Street, accountant.

Garrett, George F. H. (Liq.), Manchester Street, Oldham, watchmaker. Tr., D. Cowen, 38, Withy Grove, Manchester, jeweller.

Cain, Henry C. (Bkt.), Halifax, jeweller. Tr., W. Roberts, Halifax, accountant.

Dividends.

Furneaux, Wm. S. (Liq.), Tottenham Court Road, jeweller. 1st and final div. 5s. 7¾d.; any Wednesday between 11 and 4; L. Hasluck, 5, Jeffrey's Square, St. Mary Axe.

Langford, Edwin (Bkt.), Bristol, watchmaker. 2nd and final div. 9d.; A. J. E. Williams, Bristol, accountant.

Adams, Joseph (Liq.), Coventry, watch manufacturer. 1st and final div. of 9d.; H. Merrick, Earl Street, Coventry.

Dissolutions of Partnerships.

Land and Gledhill, Sheffield, electro platers and gilders. Sept. 25. Debts by Thomas Land.

Adjudications of Bankruptcy.

Cain, Henry Charles, Princess Street, Halifax, jeweller. Sept. 26. C. C. Halifax, Oct. 14 at 11.

Allgemeines Journal der Uhrmacherkunst.

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DIAMOND MERCHANTS' CLUB.

IT is now about twelve months since we first announced the formation of this Club, and, as we then predicted, the movement has proved a decided success.

The Club, now counting close upon a hundred Members, has taken permanent premises at 146 Holborn, in the immediate neighbourhood of Hatton Garden. The upper floors of a spacious warehouse have been very elegantly fitted up for the use of its Members, and the arrangements as regards convenience, comfort, light, and ventilation leave nothing to be desired. Adjoining the Club-room are a number of small offices, provided with scales, weights, and every other requisite for the transaction of business in this special branch. Immediately above the Club-room are the means for whiling away a lull in business, in the shape of two handsome billiard-tables. The Club provides also an excellent cellar and kitchen. The Executive Committee consists of the following gentlemen:—

A. Auerhaan, Esq., President.
S. Goldman, Esq., Vice-President.
S. Lindon, Esq., Treasurer.
M. Davis, Esq., Hon. Sec.

These gentlemen are indefatigable in their endeavours to further the interests of the undertaking and to render the Club at once profitable and pleasant. Persons desirous of participating in the advantages offered by this Club may obtain all particulars by writing to the Secretary at the above address.

A CLOCK WITH A DETACHED TRAIN.

PROF. G. FORBES described a clock with a detached train before the forty-eighth meeting of the British Association held at Dublin in August last.

In the course of some experiments still progressing he used a clock to give electric signals every second. It has a train of only one wheel working in a pinion. It is driven by a weight which falls through 5 feet in an hour. This clock only goes one hour, but serves the purpose for which it was made. He wished lately, however, to make it go for a longer time, so he drove it by a weight hung by a pulley in an endless chain in the usual way, and he attached a common five shilling Swiss alarm clock to the chain to wind it up continuously. This answers so well that he would suggest a similar construction as not only the cheapest, but also the best form of a clock with escapement with no train whatever, with an endless chain or thread passing over a pulley on the axles of the scape-wheel, and over the minute wheel of a secondary clock hanging between them in a festoon which supports the weight by a pulley. The secondary clock gives the hours and minutes, and the clock without train shows the seconds. We thus have a clock without the errors introduced by a train. It is a gravity escapement without the locking friction.

TREASURE TROVE.—In digging the foundations for a new shaft in the rear of premises belonging to Messrs. Morgan and Co., in Long-acre, some workmen discovered a chest containing a large number of gold and silver coins of the reign of Henry VIII., in a high state of preservation. Besides a quantity of miscellaneous articles the box contained upwards of twenty pieces of what is believed to be valuable Church plate. Among these were a massive chalice, ciborium, and monstrance, all of which were set with precious stones; a finely-carved crozier head, a lapis-lazuli crucifix, a pectoral cross with gold chain attached, some small vessels, and what is believed to be an abbot's or bishop's mitre. At the foot of the chalice a cross with a nimbus is engraved, and in a scroll the inscription "Ad majorem Dei gloriam." A very old house until within a week or two ago covered the spot where these things have been found.—*Pawnbroker's Gazette.*

TO WATCH DEALERS.—A Swiss firm, which makes the manufacturing of gold lever and remontoir (*au pendant*) watches a speciality, and capable of supplying first-class work on the latest principles, and at lowest prices, is desirous of entering into relations with a good English house. Samples at disposal. Offers to be addressed to F. W., 150, Office of this Journal.

WANTED, old Soldiers' and Sailors' WAR MEDALS, gold, silver, or bronze. Good prices given. Address to W. H. Runeckles, 1, Square Road, Halifax.

TO CLOCK MAKERS.—Wanted, several good hands accustomed to large work. Apply to Gillett and Bland, Steam Clock Factory, Croydon.

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THE WATCHMAKER JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

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HOROLOGY.

(*Continued from page* 58.)

XXXVII.—The Pendulum—*continued.*

We have once seen it applied it to an ornamental French clock, with a movement in it that required a pendulum much longer than the height of the case would allow to swing. The result was satisfactory as regards the slowness of the vibrations, but the regularity of the time was not as good as that of a pendulum of the usual construction. When instances of this kind occur, as they sometimes do if filing a little off the ball has not the desired effect, it is always cheaper and better either to alter the train or get another movement. When a clock has to be placed in a building where there is not sufficient room for the pendulum near the dials, it is always preferable to place the movement in some situation where there *is* room, and make a connection between the movement and the dials by means of shafting made of light tubing.

An opinion is prevalent among some people that watches and clocks are on principle the same, and it is true to a limited extent they are. The wheel and pinion work of both class of instruments, up to the escapement, are in principle the same. The main spring and fusee, and also the going barrel, are used in both clocks and watches as occasion may require; still, although these parts be the same in principle, how few think of the scheming and planning necessary in arranging them to answer all the requirements of the particular purpose intended. To construct a watch, and arrange the component parts so that the watch, or its case, will conform to every caprice of fashion, and at the same time be a safe and reliable time-keeper, or to construct a clock to fit a building where some unaccommodating architect, considering all that was necessary for the clock was to leave holes in the walls for the dials, involve questions altogether different from each other, and bear but little resemblance, further than in both instances they are often ill-requited labours, if the artist has a conscientious desire to have his machine mechanically correct.

The modes of reasoning, and the principles that are involved in perfecting the marine chromoneter, are altogether different from those for improving the astronomical clock; and in reality there is but little similarity between watches and clocks, except that they are both used for the same purpose—that of measuring time. To such of our readers as may not be familiar with all the questions involved in adapting the pendulum for measuring time, we would advise them, in studying this subject, to banish from their minds all theories about watch or chronometer balances and balance springs, and their various peculiarities, because they bear no parallel to the subject under consideration.

We have described the laws that govern the motion of a pendulum, and the peculiarities of the various forms of pendulums used for measuring time. Before entering upon the question of compensation, and the general effects of heat and cold upon pendulums, we shall first consider some of the causes that tend to disturb their natural vibrations, and the influence which the various forms of escapements exert on the motion and regularity of the vibrations of the pendulum. For the benefit of those who may not be conversant with all the branches of the subject, we propose to give a detailed description of the anchor or recoiling escapement, the dead beat, or Graham one, and other escapements of that class, and also of the various forms of gravity and detached escapements of ancient and modern construction, and of European and American invention, and the influence they have upon the pendulum.

The *Vertical*, or verge and crown wheel escapement, used in the early days of clock-making, may now be considered to be obsolete; and although there are many important questions involved in its construction, it is unnecessary to occupy the space of the Journal to give a description of it at present, as the necessity of its use has been avoided by other escapements that have entirely superseded it, and which are more easily made, and better adapted for every purpose approaching to accuracy in performance, which is the point we aim at.

Recoiling or Anchor.—In the year 1680, or 1681, Mr. William Clement, a London clockmaker, produced a clock with the escapement known at the present day as the anchor or recoiling one. This escapement allows the scape-wheel tooth to escape with a much shorter arc of vibration of the pendulum than the old verge one allowed, and the arc of vibration being smaller, a longer and heavier pendulum can be used, with a smaller driving weight. The arc of vibration being materially reduced, the necessity for any attempt to make the pendulum describe a cycloid was obviated, although we find that Berthoud, and other horologists of less eminence, devised plans to obtain this object by making the faces of the pallets a particular shape, and this idea lingers among a portion of the trade at the present day.

As it is with all important discoveries or improvements, so it was with the recoiling escapement. Several claim the honour of the invention. Mr. Clement had no sooner given a description of his escapement to the world, than Dr. Robert Hooke, a celebrated mathematician of that time, whose father was a watchmaker in the Isle of Wight, claimed that in the year 1666, fourteen or fifteen years previous, he showed to the Royal Society a clock having this kind of escapement, and it is generally admitted that Dr. Hooke's claim to priority of invention is just, although the fact in no way detracts from the credit due to Mr. Clement for his labours.

The recoiling escapement has in its turn been superseded by others where great accuracy is required; still it is one by far the most extensively used in all countries in clocks intended for the ordinary purposes of life. It is the prevailing escapement in those clocks having seconds pendulums and tall cases that are to be found all over the British Isles, and in countries and states of British origin. The owners of almost every one of these clocks tenaciously adhere to the notion that *their* clock is the best in the whole town or parish, although in some instances the mechanical execution of these same clocks may be of the most wretched execution; and this circumstance proves in a forcible manner the superiority of clocks having long pendulums over those having shorter ones, although they are made with a greater amount of care. The recoiling escapement is also used in different forms in Scandinavian countries, as well as in Holland, and all over Germany and the South of Europe, and to a large extent in those charmingly executed French mantle-piece clocks of modern construction. It is the escapement universally adopted in American clocks.

All these recoiling escapements, although differing in form, are in principle the same. The faces of the pallets are shaped in such a manner that, when the pendulum is made to ascend beyond the perpendicular line, the pallets impart to the scape-wheel a retrograde motion, or, as it is termed, a recoil. So soon as the pendulum has reached the extremity of its arc, and begins its return course, this force, that has been stored up by the recoil of the wheelwork, acts with the force of a spring that has been compressed, and causes the scape-wheel teeth to press on the pallets, and thereby communicates a force to the pendulum. This force maintains the vibrations of the pendulum, that would otherwise fall off gradually owing to the friction of the pallets on the scape-wheel, and the resistance offered to the pendulum by the density of the atmosphere, and from the stiffness of the suspension spring. This recoil maintains the vibrations of a pendulum with the old vertical escapement exactly in the same manner as in an anchor, and so far as the quality of the impulse given to the pendulum on its descent, or the nature of the resistance that the pendulum meets with on its ascent, there is but little difference; and the superiority of Hooke's escapement over the vertical one consists principally in the easiness of its execution, the better action of the wheelwork, and the shorter oscillations that are required to be made by the pendulum.

Still there are, however, some eminent clock-makers who in past times and at the present day entertain an idea that these short arcs of vibration are not to be recommended. Cumming, an English clock-maker of the last century, and the author of an essay on the "Elements of Clock and Watch Making," which he dedicated to King George the Third, takes extreme grounds on this point, and advocates vibrations of great extent, without giving any good reason whatever for his opinion. The scientific man finds no proof among nature's laws that will confirm the utility of large arcs of vibration in a pendulum designed for an accurate measure of time. The supposed necessity for large vibrations, and also the supposed necessity for a pendulum to describe a cycloid, in our estimation consists in the fallacy of applying rules that were applicable and also necessary for the original vertical escapement to *all other* escapements, as if these rules were dogmas to be followed on all occasions and under every circumstance. Here we would remark, for the benefit of those workmen who, in making and repairing clocks, imagine that large vibrations are beneficial, if an escapement has been originally designed and drawn off in such a manner that the pendulum will have to make a large vibration before the wheel will escape, and after the clock is made or has been repaired the pendulum does not take the desired vibration, it indicates that something is wrong—probably too much drop to the teeth of the scape-wheel; and in these instances, which often occur, the clock will not go well, and will be easily stopped. Still it will be apparent that this circumstance cannot be taken as an argument against small vibrations, when the escapement is designed and executed with the object of small vibrations in view.

(*To be continued.*)

ELECTRIC LIGHT AND GEMS.

MR. FRANK FLOWERS, the well-known Piccadilly jeweller, in a letter to *The Times*, states that the electric light does not affect the natural colour of gems. It is well-known that a diamond of a decided "off-hand" colour will appear a "white" stone under gaslight, and not even the most experienced diamond merchant would venture to make purchases after day-light. His business hours in winter time are therefore inconveniently limited, and he will no doubt hail with delight an invention which will do away with so serious a draw-back.

A WORD OF WARNING.

To the Editor of the Watchmaker, Jeweller & Silversmith.

Sir,—It has been asserted that English silver-ware is "held in high estimation abroad." My acquaintance with Board of Trade returns, which are a very fair test of the estimation of foreigners for British productions, leads me to question the truth of this assertion; I feign would believe it, but I cannot. However, one must admit that up to a short time ago such silver plate as was imported into Australia was of British manufacture. I say "up to a short time ago," as, when in America, I made careful inquiries as to whether the trade in silver-ware had made much progress in Sydney, Melbourne, or Adelaide. Of course, I was much interested in discovering whether American manufacturers were endeavouring to supplant us in our own colonies. Again, my brother, who was in Australia in 1875, tells me that he then saw no American plate in any of the stores.

But the thin end of the wedge has since been inserted, and the lever of education, capital, and intelligence has already opened the Australian trade to American enterprise. Travellers have been sent off, and orders have come in. Large chests were being packed, containing goods which I knew well enough would attract buyers (I only wish I could be allowed to sell such goods myself; there would be no difficulty in finding customers); and one saw at a glance that, however much or little English silver-ware was held "in high estimation" abroad, it would not be held very long in high estimation in Australia.

And, now, sir, the newspapers have told Australians that English silver-ware is not held in high estimation in Paris. By this time, doubtless, our quicksighted cousins across the Atlantic have notified to their correspondents that American silver-ware has "whipped the world," and it may safely be asserted that, in view of the approaching Australian Exhibition, the workshops of America are busily engaged in the production of goods which they hope may elbow the Britishers out of the market.

But, it may be asked, what are our silversmiths doing? Why, playing into the hands of their American rivals, by putting themselves shoulder to shoulder before a Select Committee of the House of Commons, to prevent the abolition of those "old, antiquated, and mischievous laws" which alone prevent the development of their trade.

And what is our Goldsmiths' Company doing? We have all heard the old story, "What are you doing, John?" "Nothing, sir." "What are you doing, James?" "Helping John, sir." But it is far worse than this, the Goldsmiths' Company at the present time is shoulder to shoulder with the Silversmiths', assisting to the best of their power in the work of obstruction! Thus it is that, ere long, we may expect to see the grand prize at the Australian Exhibition handed over to America, and to find our trade with the colony a matter of history, as proved by "closed accounts in our manufacturers' ledgers.

Yours, &c.
Edward J. Watherston.

Pall Mall East.

We can speak from personal experience that American plate is largely supplanting our productions in Australia. Our silver-plate is bought there not on account of its artistic excellence but because it is English. Some of the colonists like to look upon it, because it reminds them of days long past, of the dear old home. The same class of people buy English cheese, for instance, although an equally good and often better article can be supplied by the colonies at half price. These good old people would never acknowledge that the colonies can match the old country in anything. Cheesemaking, they say, is an old industry in England, and it is not to be expected that "Young Australia" should be able to compete with it. According to such reasoning English silver-plate should be better than American, because the craft existed in England even before the discovery of Columbus. It ought to be, but we regret to say that it is not!—These patrons of our silversmiths are, however, fast dying out, and the rising generation is learning to appreciate beauty and skill independent of origin; in fact, "Young Australia" has a good deal of the Yankee element, it is ever on the alert for novelties and improvements, and English ways are altogether too slow for them. American firms are largely and influentially represented in Sydney and Melbourne, especially at the latter place, and we may depend that they will lose no opportunity for bringing the excellent wares of their silversmiths prominently before the public. The loyalty of the Australian colonies to the mother country is however such that they would prefer to deal with us, always supposing that we can offer the same advantages as our competitors. We need hardly point out what an immense field wealthy Australia offers to our silversmiths, and the timely warning of Mr. Watherston deserves the most serious consideration.—Ed.

To the Editor of the Watchmaker, Jeweller, & Silversmith.

Sir,—Permit us to state a few facts in connection with the "American gentleman's" evidence before the Select Committee on Hall-marking, which Mr. Gorham Thurber, of the Gorham Manufacturing Co., Providence, U.S.A., in his letter to Sir Henry Jackson, M.P., has, we believe, inadvertently misrepresented.

He did not state "that American manufacturers would greatly prefer to have a system of *compulsory* hall-marking," and what he did say had no reference whatever to silver-plate.

No question was put to him on the matter of hall-marking silver-plate, he had nothing to say in relation to it. Watch-cases and silver-plate are distinctive manufactures, the only resemblance is that the metal employed is the same.

He did urge a compulsory distinctive mark on *watch-cases* made for other than English movements, and this in the interest of the English, as well as our own manufacture. Thousands of watches made on the Continent are put into hall-marked cases, engraved with English names, and the same thing is done in imitation of our movements.

The honest English maker wants to stop this fraud, so do we; and as the English people will not buy a watch without the case bears the hall-mark guaranteeing the standard, he proposed all foreign watches (our own of course included) shall have stamped on the *case*, the name of the maker of the movement in addition to the Government mark: that is all he had to say about compulsory hall-marking.

We imagine Mr. Thurber would be a very warm advocate of hall-marking, if like circumstances applied to silver-plate.

Yours very respectfully,
Robbins and Appleton.

London, 22nd November, 1878.

BOOK NOTICE.

Treatise on Modern Horology, in Theory and Practice. Translated from the French of Claudius Saunier by Messrs. Julian Tripplin and Edward Rigg, M.A.

Part XI. is now in the press, and with that number will terminate the portion of that work devoted to the undetached escapements, viz., Verge, Cylinder, Duplex, etc.

With Part XII. will begin the Theory of Detached Escapements, followed by exhaustive theoretical and practical details relating to the Lever, Chronometer, etc.

The escapements employed in clocks of all kinds will then be fully considered, prior to entering upon the study of Depthing, Springing, and Timing, etc.

HINTS TO REPAIRERS.

In the practice of watch-repairing there are many little appliances, and certain methods of performing various little jobs of work, the object of which is, in some instances, to save time and labour, and in others to impart a more perfect finish to the work. These little secrets, which to the accomplished workman would seem too insignificant to mention, would be more prized by the unskilled artizan than the most elaborate scientific essay on any subject connected with the manufacture of watches. To the workman whose occupation is that of a repairer only, any little assistance in the direction of saving time or labour is eagerly welcomed.

A trouble much experienced by unskilled workmen, after replacing a broken cylinder or staff, is to find the proper place for the hair-spring stud in order to effect the proper beat. They manage to find it, it is true, but only after the expenditure of much time and labour, pushing the collet hither and thither until the proper " beat " is effected. In the case of a cylinder much time may be saved by putting the balance-wheel and bridge in position, being careful to screw down the bridge firmly to prevent shaking—a trouble often experienced with worn watches; the balance is then moved to such a position that a tooth of the escape-wheel rests on one of the impulse arms of the cylinder, it being immaterial which, and the point on the balance exactly opposite the stud hole will be the proper place for the hair-spring stud.

In a lever escapement the proper place for the stud is found by placing the balance in such a position that the ruby pins stand directly in the centre, between the two banking pins or abutments, and the point on the balance exactly underneath or opposite the stud-hole is the proper place for the hair-spring stud. This brings a tooth of the escape-wheel on one of the impulse planes of the pallet, which is the proper position. In general, the lever or cylinder escapement must be so adjusted that, when power is applied (wound), it will start of itself, without being shaken to bring it into action. In the Duplex escapement the proper place for the stud may be found by placing the balance in such a position, that a long tooth of the escape-wheel rests on the duplex roller, exactly between the slot and impulse pallet; the point on the balance-wheel exactly opposite the stud hole in the bridge being the proper place for the stud. The impulse jewel when in action should be 5° in front of the impulse tooth before receiving the impulse. The diameter of the duplex roller should be one-fourth the space between two long teeth of the escape wheel. In the case of a chronometer escapement, the proper place for the stud is found by placing the balance in such a position that the gold spring is exactly between the impulse and unlocking jewels; in such a position the point on the balance directly opposite the stud hole is the proper place for the stud. The impulse jewel when in action should be 5° in front of the tooth before receiving the impulse. The chronometer and duplex escapements, unlike the lever and cylinder, require to be put in position to perform. This arises from the nature of the escapement. To underturn the face of a pinion, staff, &c., nicely, should be an object of solicitude to every repairer, as it gives a beautiful appearance to the finished work; but to some workmen underturning presents many difficulties. The easiest manner of accomplishing this is by constructing a graver whose face, when ground, presents the shape of an acute cone, and which must be well hardened and tempered. The graver is then held in the position as if a point were to be turned in the direction of the underturning, which will effect the desired result. Care must be taken not to press the graver too hard against the object to be turned, as the point of the graver (the essential part) would be in danger of breaking, but should be held gently, yet firm. After grinding any graver it should be polished by rubbing it across a piece of chamois leather stretched on a piece of wood, and impregnated with rouge. Any metal (unless it be too hard), especially brass, on being turned with a graver thus prepared, presents the part turned with the appearance of having been polished.

It is very often necessary for the repairer to replace a hair-spring, and although this is not a very difficult job, it generally occupies the unskilled workman the greater portion of a day. By observing the following directions any workman will be enabled, with a little practice, to adjust a hair-spring suitable to the watch in the space of a quarter of an hour: first, ascertain the number of vibrations the balance makes in a minute, by counting the wheel teeth and pinion leaves (as will be explained in our next). Generally English watches beat 240, Swiss 300, and American either 300 or 270 per minute; secondly, select a spring whose outer coil lies naturally in the regulator pins at the same time that the inner coil is opposite the cock-jewel, and temporarily fasten it to the balance staff with wax, and pin the outer coil into the stud, and place the balance thus into position. Wind the watch one turn, and allow it to vibrate exactly a minute, as indicated by a good regulator. Should the number of beats the balance makes in this minute coincide with the number of beats the watch ought properly to make, as before determined, then the spring is one well adapted to the watch; but should it lose or gain vibrations in the minute indicated by the regulator, it proves the spring to be either too weak or too strong, and must be replaced by one suitable. It is not always necessary to change a spring should the difference be slight, as it may be regulated by giving greater length to, or shortening the length of, the hair-spring.

(*To be continued*).

GREENWICH TRIALS, 1878.

The results of the Greenwich Chronometer Trials for 1878 are hardly satisfactory if compared with previous years. Out of the twenty-nine instruments entered the following six rank first:—

No. 478 by Pyott, 7 Jamaica Ter., West India Dock Road.
„ 3,381 „ Ainsley, 86 Bute Street, Cardiff.
„ 3,482 „ Fletcher, 95 Leadenhall Street, E.C.
„ 3,472 „ Mann, The Cross, Gloucester.
„ 4,240 „ Sewill, 61 South Castle Street, Liverpool.
„ 1,817 „ Moore, 114 High Street, Belfast.

The differences between the greatest and least weekly sum were 11.0, 14.5, 10.0, 17.5, 16.1, and 19.9 seconds respectively, and the greatest differences between one week and the next 5.5, 4.7, 7.2, 5.5, and 6.6 seconds respectively. These two sums were only 9 seconds and 3½ seconds for the best chronometer at last year's trials, in the case of No. 1,612, a chronometer constructed by H. P. Isaac, of 10, Spencer Street, Clerkenwell.

A London paper, describing the technicalities of the goldsmith's art, mentions a process which is doubtless new to the Birmingham jewellery trade. The editor gravely writes: " The neat, fine, gold like appearance is produced *by immersing the jeweller* for a few minutes in a boiling solution of muriatic acid three parts, saltpetre two parts, salt one part. This eats out the alloy and brings the fine gold to the surface." We are not told how the jeweller relishes this rough but scientific treatment.—*Martineau and Smith's Hardware Trade Circular* (Birmingham).

The Corporation of Geneva has voted a sum of about £700 for the addition of a mechanical department to the Horological school of that city.

TRADE RECIPES, &c.

Fitting and Repairing Balance Staffs.—In the latter part of the third chapter of "Grossman's Treatise" there is described a balance staff that is a plain arbor without collet or shoulders for hair spring or balance, the spring collet fitting to a part of the balance, and the staff fitting tightly into a long small hole through the balance. The advantage to be derived from this plan is in being enabled to adjust the height of the balance, especially in English watches, as this staff can be driven either way. This plan is only applicable when a new balance is to be made. The same advantages can be obtained by the repairer in replacing a broken staff only. Fit a piece of brass wire, large enough to make the staff collet, into the drill chuck, or in any other manner to the lathe; turn the socket for the spring collet, also for the balance, and fasten the balance on with a burnisher before removing from the lathe. Drill the hole the size of the staff, and cut the collet from the lathe with a fine saw. The staff is but a straight arbor fitted tightly into this hole. Besides the advantage of making little alterations in the height of the balance, this staff is easier to fit, even the first time, than the very poor ones sold by the shops; and if ever broken again, it is only necessary to fit the straight arbor. As good steel as any for this purpose is a sewing needle of the right size, the temper drawn to a deep blue.

To Frost Watch Movements.—Mix together 1 oz. each muriatic acid, nitric acid, and common salt; immerse the article, as far as it is to be frosted, in the mixture for a short time, then immerse it, so as just to cover it, in sour beer, and scour it under the beer with a scratch brush; wash it in water, and afterwards in alcohol. The surface is then ready to gold or silver plate if desired.

A cheap Galvanic Battery.—Take a gallon stone jar, place a sheet zinc cylinder therein, and inside that a porous cup (a porous flower-pot with a cork fitted in the hole will answer after a fashion). Inside the porous cup place a piece of sheet copper. Use a solution of common salt next the zinc, and a solution of sulphate of copper next the copper in the porous cup, if a strong current be desired. The liquids inside and outside the porous cup should stand at the same level. Dilute sulphuric acid (1 part acid to 10 water) makes a very constant but weaker current.

To work up Gold Filings, &c.—The following process is very useful for working up filings and scraps of gold, gold-plated jewellery, &c. It does not, of course, refine the gold, as in the usual process of quartation. It merely destroys the filings of copper, silver, German silver, brass and other metals acted upon by the acid. It will eat the solder or brass out of hard soldered and plated goods, leaving the thin shell of gold. The iron filings are thoroughly separated from the mass by the repeated use of the magnet. All pieces of soft solder and lead should be picked out, and if there is much soft solder in any of the plated articles it should be melted out, and the residue then placed in a shallow glass or china vessel and rather more than covered with good nitric acid. When the bubbles cease to agitate it, the acid should be poured into another cup, and if there is any base metal left, more acid should be added, and the mass stirred occasionally with a strip of glass. When no bubbles appear on adding new acid, that may also be poured off, and the filings washed two or three times or until perfectly clean, letting them stand a minute or two to settle before pouring off the water. They are then dried and melted. The filings and scraps treated in this way seldom require more than one melting to make them easily worked and fit for jobbing. There is no skill required, only considerable care in the handling. The silver remaining in the acid may be precipitated in the ordinary manner with common salt. The chloride obtained is fit for the repairers' plating solution, or may be melted into a button, and being pure silver, used as an alloy for other gold.

To Imitate Old Silver.—To imitate old artistic productions made of solid silver, the ground-work and hollow portions not subject to friction are covered with a blackish red earthy coat, the parts in relief remain with a bright lead lustre. Mix a thin paste of finely-powdered plumbago with essence of turpentine, to which a small proportion of red ochre may be added, to imitate the copper tinge of certain old silver ware; smear this all over the articles. After drying, gently rub with a soft brush, and the reliefs are set off by cleaning with a rag dipped in spirits of wine. Old silver is easily removed, and the brightness of the metal restored, by a hot solution of caustic-potash, cyanide of potassium, or benzole. To give the old silver tinge to small articles, such as rings, throw them into the above paste, rub in a bag with a large quantity of dry fir-wood sawdust until the desired shade is obtained.

Test for the Silver on Silver-plated Metals.—Boettger recommends a test fluid consisting of a saturated solution of bichromate of potassa in nitric acid, specific gravity 1.2. Any dirt or varnish having been removed by strong alcohol from the metallic surface to be tested, a drop of the test fluid is applied to it by means of a glass rod, and immediately afterwards washed off with some cold water. If pure silver is present (as regards silver coins, these are left in contact with the test fluid for a greater length of time), there will appear clearly a blood-red coloured mark (chromate of silver). Upon German silver the test liquid appears brown, but after washing with water the blood-red coloured mark does not appear. Britannia metal is coloured black; on platinum no action is visible; metallic surfaces coated with an amalgam of mercury yield a reddish speck, which, however, is entirely washed off by water; on lead and bismuth the test liquid forms a yellow-coloured precipitate; zinc and tin are both strongly acted upon by this test liquid, which, as regards the former metal, is entirely removed by water; while, as regards the latter, the test liquid is coloured brownish, and addition of water produces a yellow precipitate which somewhat adheres to the tin.

THE DIURNAL OSCILLATION OF THE BAROMETER.

MONS. RENOU has recently communicated to the French Academy the following results of his study of this subject. The sun warms the atmosphere which recedes all around and produces a rarification over a great circle. This effect is arrested a short time after the maximum daily temperature has been attained, that is, towards four o'clock in the afternoon, and produces a maximum of pressure all over the countries situated, on the one hand, six hours to the west, and on the other hand six hours to the east; or in other words the countries which reckon ten o'clock in the morning and ten in the evening as local time. The atmospheric wave which produces this effect follows the apparent motion of the sun, and shifts its position with a velocity which at the equator reches 464 metres per second. This wave by its rapidity and the direction of its movement should produce a higher maximum in the morning than in the evening; it should also give a predominance to the morning or the evening maximum according as the winds blow from the west or the east. The minimum of the night is only a relative minimum comprised between the two maxima of the evening and morning. The barometic pressure at 4 a.m. ought to differ little from the mean of the 24 hours. In reality it is some hundreths of millimetres lower, because of the loss of weight due to dew and other causes. The diurnal movement of the atmosphere necessarily produces a diurnal variation in the direction of the winds—a variation, however, which is difficult to recognise. Easterly winds favoured by the morning wave rise early and end almost at sunset. Westerly winds opposed by the morning wave are often allayed then, and swell up again in the evening.

HALL-MARKING AND DUTY QUESTION.

We have before us the Report of the Select Committee on Hall-marking, and although the evidence is voluminous, we have carefully perused its contents, and given the matter that consideration which its importance demands. As might have been expected from a question affecting different branches of the precious metal trades, with interests not always identical, the evidence shows considerable diversity of opinion. We most heartily wish to see every trade prospering, and all obstacles removed which would render such a happy consummation possible, but at the same time we decidedly protest against any attempt to secure the prosperity of a few large firms at the expense of the trade at large.

What is the actual state of affairs? A score or so of manufacturing silversmiths enjoy a protection which effectively excludes all further enterprise in this industry, and consequently makes commercial as well as artistic progress impossible. This protection they are naturally desirous to retain—a desire which we can well understand, seeing that they can thus divide the whole profits of the trade, which, although remarkably less than they used to be, form still a very acceptable income among such a small number. Now, we have an equally limited number of watch-case makers who sigh after similar blessings, and which can only be granted by injuring all the other branches of the watch trade, supplying a living to a far greater number. To every man employed on watch-cases there are about nine for the works. Whether the government is going to confirm this monopoly to the former, and to grant the same obstructive weapon to the latter, remains, of course, an undecided question till the re-assembling of Parliament; but we may not unreasonably expect that a policy which fills the pockets of a few to the detriment of the many will not be countenanced. Our own course in the matter is clear; our task is to support measures which tend to procure the greatest amount of business to the greatest number, and from the most careful study of the present subject we feel convinced that an important step in this direction will be the abolition of the duty on silver-plate, and the introduction of a *voluntary* Hall-marking system.

We will now briefly summarize the evidence which has been urged for and against these measures. All the witnesses seem to agree that there is room for improvement.

Mr. E. J. **Watherston** strongly objects to the duty on silver-plate, and supports his objection with an array of facts and arguments which remain unrefuted. He advocates a voluntary Hall-mark, and the introduction of the French system of testing articles by the touchstone instead of the cupellation process, which so injuriously affects works of art sent for assay to Goldsmiths' Hall. The system of allowing a drawback on exported goods he justly condemns as being liable to abuse; also the rebate on unfinished plate sent for marking, which forms no small item of profit (one manufacturer confesses to have derived a thousand a year from that source); by abolishing the duty both these abuses would, of course, be done away with. Is it to be wondered at that the manufacturing silversmith uses his utmost exertions to preserve a duty which forms an actual source of revenue to him? He called attention to the immense progress which America has made in the manufacture of artistic silver-ware, and stated that far superior plate was now made in the States, owing to the complete freedom which the trade enjoyed there. This statement is borne out by the testimony of the Gorham Silver Manufacturing Company, of Providence, a firm which alone makes up more silver than all the English silversmiths combined, and Messrs. Tiffany and Co., of New York, who obtained the Grand Prize for art silver-work at the Paris Exhibition. Mr. Watherston thinks that the plate-license should also be abolished, an opinion which we readily endorse, and we shall have more to say on that subject at some future occasion. He also argued against the passing of the Watch-Case Makers' Act, as it would not do away with the abuse which was really to be got rid of.

Mr. **Garnett**, of the Inland Revenue, gave evidence relating to the existing laws in practice, the amount of the revenue, the manner of its collection, the condition of the various assay offices, &c.

Mr. **Garrard**, a manufacturing silversmith—we need hardly say, does not approve of any change, and considers a voluntary Hall-mark impracticable. His evidence on several points is entirely at variance with that of Mr. Watherston. He stated that the greatest care was taken at Goldsmiths' Hall in the process of assaying and marking, and that the Custom-house offered every facility for exporting plate, but in what manner these facilities are to be obtained he does not state. The Custom-house officers, he said, came to his shop, superintended the packing and sealed the cases, which were transmitted under their charge to the place of shipment. Mr. Watherston, on the contrary, asserted that he had suffered considerable loss in passing plate through the Custom-house in order to obtain the drawback allowed on exported plate. The plate, he stated, had all to be unpacked at the port, pulled to pieces, weighed, repacked (often carelessly), and the result was frequent damage in transit. It does not devolve on us to account for such different modes of treatment on the part of the Hall and Customs officials, but it seems rather strange that advantages are granted to one member of the trade which are denied to another. This is a matter which should certainly be inquired into by the proper authorities. Have Mr. Watherston's endeavours to root up old institutions, which time has not only rendered useless but injurious, anything to do with it? If that gentleman has been unfortunate enough to bring the wrath of Goldsmiths' Hall on his head, we may congratulate him that the earlier laws of that body are not now in force, or he would stand a good chance of being pilloried and having a piece of his ears cut off. Mr. Garrard further stated that a large meeting of the trade, held at St. James' Hall, were, *in his opinion*, strongly opposed to change; but when the composition of that meeting is taken into consideration there is no matter for surprise, only 60 out of 12,777 licensed dealers were present or represented. In the excellency of American plate he does not believe. We doubt whether he has ever seen any, or else he could not make such a statement.

Perhaps the jury which awarded the Grand Prize to Messrs. Tiffany and Co. does not know what constitutes good work. A glance at the catalogues of some of the leading American silversmiths, illustrating specimens of their general stock, is sufficient to convince the most sceptical of the superiority of American productions. These are facts and not mere "Yankee bosh," as Mr. Garrard would like to make out. Nothing is more dangerous than to lull ourselves to sleep with the idea that we have nothing to fear from foreign competition; many of our manufacturers have of late years been rudely shaken out of such a fool's paradise.

We have designers and workmen in this country capable of securing us the highest rank as silver workers, but they naturally do not follow a trade which offers no inducements. A French critic, in the "Gazette des Beaux Arts," when speaking of the gold and silver work at the Paris Exhibition, says that France still occupies the leading position in that department, but, he adds, "if America brings forth some more Tiffanys, and England uses the same efforts in this branch as she has applied to furniture, we shall have to struggle hard to retain our supremacy." The cabinet-makers have to thank free trade and wholesome competition for the excellence they have attained and the reputation they have earned. Another French authority, Mons. F. de Lasteyrie, a member of the Institute, also acknowledges that the English silver-workers, with more art and technical knowledge, would outstrip all their rivals. But the silver trade being unfortunately without those stimulating influences which have made our cabinet-makers, glass, pottery and textile manufacturers so famous, remains not only stationary but is retrogressive. It is no wonder that some of our *working silversmiths*, who love and honour their calling for its own sake and not merely as a mercantile speculation, should feel indignant when they think of what their ancient craft has once been, and what it is now; from an art which administered to the highest and most cultured in every civilized country, and to which even a Durer and Holbein did not disdain to supply designs, it has gradually sunk to a mere mechanical business. The models of our manufacturing silversmiths are as conservative as themselves, and it is no wonder that they cannot build up an export trade. The public taste is rapidly increasing, and that class of people which buys silver plate for the sake of the metal only is on the decrease, so that our silversmiths will have to look out for worthier models if they wish to cater for a highly-cultivated society. They will have to study the classic productions of every style which has been preserved to us, not with a view to imitating them, but as a means for originating new ideas. First of all, the trade must, however, be emancipated from its present fetters, as without perfect freedom it will never be able to enlarge its sphere, and next we must introduce the modes of manufacture of our successful rivals on the other side of the Atlantic. They have learned the art from our workmen, and have improved on it; now we must return the compliment. Perhaps many of our readers are not aware that some of the best English silver workers have settled in the States, probably tired of making Queen's and Fiddle pattern spoons. They longed for a freer atmosphere, where their craft might better develop. We say, once more, let the trade have freedom, and we shall soon be able to give a better account of this most important branch of ornamental art, both as regards financial and intellectual progress. We shall also be spared such humiliating announcements as the following:—

Saturday Review of September 14th.—"In one of the abortive exhibitions held a few years ago in the hot galleries which adjoin the Conservatory of the Horticultural Gardens there was a melancholy show of modern plate. Few people saw it in all probability; and we do not remember that it was noticed in the newspapers, though many thousand pounds' worth of bad designs were exhibited. A visitor who believed in the vitality of English art could not find a single specimen which he would have taken or given as a present, and declared that he would have preferred, to the best cup or group, as much unworked metal in a lump."

Mr. Thomas would preserve the duties as the only means of preserving the Hall-mark. Perhaps this gentleman was not aware that the Hall-mark prevailed for 400 years before a duty was ever thought of. He thought the regulations under which foreign plate was imported into this country bore hardly on manufacturers.

Mr. Prideaux, Clerk of the Goldsmiths' Company, presented a summary of the Acts and Charters of the Company and gave a general outline of its usages. By some statistics he intended to show that the depreciation in the silver trade was solely due to the introduction of electro-plate; but he did not remark that the abolition of the duty would enable the silversmiths to compete with electro-platers, as would in fact be the case. He stated that the amount of silver used for silver plate was about 100,000 ounces less than the amount for plating (one million ounces); but he did not allude to the injustice which the silversmiths suffer if compared with electro-platers. How is it that the latter are allowed to use and sell a million ounces of silver without duty and even without a license, while the former have to pay £75,000 duty, besides about £41,500 licenses for the same privilege? We do not want the electro-platers to be taxed, but we may not unreasonably claim the same privileges for the silversmiths. Mr. Prideaux asserted that at the French assay offices, the articles were scraped just as in the English assay offices. He stated that the greatest possible care was taken at the Hall in obtaining sufficient metal for assay; an assertion we have no hesitation in believing. We must, however, differ from that gentleman as regards the usages at the French assay offices, as the scraping process is not the rule, but the exception. The French assay office reserves the right of assay, and frequently acts upon it. It has even the right of taking a specimen of the articles belonging to a jeweller, and to melt it down; but in *most* cases it is content to test with the touchstone; and considering the accurate results which can be obtained by this simple process it is difficult to see why it should not be more largely adopted at Goldsmiths' Hall. Mr. Prideaux also assured his hearers that no unnecessary injury was done to articles sent to the Hall for marking.

We might here mention that an effort was made already, ten years ago, by the Horological Institute to influence the Goldsmiths' Hall authorities "to improve their somewhat rude and antiquated method of scraping and stamping watch cases, entailing avoidable expense in repairing the distortion incurred thereby." Is it likely that that honourable body felt itself compelled to make those representations without just cause? The Institute called a meeting of the trade, and formed a deputation to the Goldsmiths' Company, though then unsupported by the case-makers, who declared themselves satisfied with existing usages. This invasion into the sacred customs of the Hall was, however, repelled, and the deputation then waited on the President of the Board of Trade, asking "to be relieved from the necessity of having their watch cases injured by the existing mode of assaying and marking by making the Hall-marking *optional*." Pressure of business unfortunately prevented the President from giving the matter the necessary consideration, and ultimately the movement collapsed through want of support.

Mr. Joseph Pyke would retain the Hall-mark, but abolish the duty. He complained of the exemptions; many articles of considerable weight being exempted as jewellery, while the smallest article of plate must be stamped. As regarded wedding-rings, from the price at which they could be bought he felt sure that the mark must often be forged. He believed the removal of the duty would enable silver to compete with electro-plate.

Mr. Walter Barnard, another manufacturing silversmith, considered the duty useful as protecting the Hall-mark. Its removal might increase the trade in silver, but not sufficiently to enable it to compete with electro-plate; and he did not think the public objected to the duty. We may safely assert that the public has not been questioned on the subject, and we fancy that it would decidedly object if it knew that the duty represents nearly a third of the intrinsic value of the plate purchased. He said that in the absence of the Hall-mark articles could be manufactured of a lower standard and it would be impossible to detect this by examination. What crime is there in making and selling utensils of an alloy containing more than 18 dwts. of alloy to 222 dwts. of silver, as long as it is not sold as standard? Have we not six different standards of gold? One of our leading gold standards contains 15 parts of alloy to 9 of gold, and nobody seems much the worse for it. To be consistent, either the lower gold standards should be abandoned, or the privilege of alloying silver with a larger percentage of alloy than is now admissible should be granted. There are many people who choose to wear jewellery below 18 carats, and there is no reason why they should not be allowed plate inferior to the present standard.

Mr. E. J. Poynter, R.A., gave evidence as to his experience of the risk of having works of art destroyed, if they proved to be below standard, when sent to Goldsmiths' Hall for stamping.

Mr. T. H. Farrer, permanent secretary to the Board of Trade, objected to any system of compulsory Hall-marking. He thought it was clear on the evidence that the manufacturers wished to keep up the system of duty and Hall-marking, as it protected them against foreign importations and kept out the competition of work of inferior material. He thought a contract between buyer and seller ample security. Goldsmiths' Hall and all its belongings he calls "a mere relic of a barbarous age." It grew out of the ancient notion that gold and silver were *noble* metals, which should not be alloyed or imitated. This was apparent in all the old statutes. He further stated that the action of the law was imperfect, as in practice it did not exist as regards gold, for the kind of articles requiring to be Hall-marked are not now made of gold. The people had no protection in buying electro-plate, although there were great differences in quality and there was no logical reason why protection was not as necessary in one case as in the other. Another objection to the Hall-mark was that it often got to be looked upon as a sort of trade-mark, testifying not only the quality of material but also the place of origin; hence the objection to foreign cases being stamped in England. Compulsory Hall-marking, he argued, interfered with manufacture, because it prevented articles being made from several kinds of metals. A voluntary Hall-mark should be established by the trade and not by Government. He did not agree with the view put forward by the dealers as to the opinion of the public; he thought, on the contrary, that it relied very little on the Hall-mark. Some dealers in plate object to the abolition of the tax on account of large stocks in hand, but this only reasonable objection might to a great extent be met by following Mr. Farrer's suggestion, to give a proper notice. He demolished the ridiculous analogy which the manufacturers thought they had established between analysis of food and metal assaying. The tradesman, he said, was punished for selling an article which was not what it purported to be, and the same would always be the case with the precious metals.

The evidence of Mr. Farrer deserves special consideration, coming, as it does, from a disinterested source, from a gentleman whose official position has made him familiar with the interests of our industries, and whose sole object in coming forward in this matter is a desire to advance British trade and prosperity. It is to be regretted that more of the independent element was not introduced into the committee.

The evidence of Mr. Walker and Mr. Read, both of Coventry, and of Mr. Rogers, of Liverpool, was given in the August issue of this Journal, to which we refer our readers.

Mr. **Bedford**, the representative of the Waltham Watch Co., stated that it was the practice of his Company to import cases from America and Switzerland into England, to have them stamped here, and then to send them back to be finished. All the works were made in America. Both works and cases were plainly stamped with the Company's name, and he would like to see a law made to prevent anyone from marking foreign watches as English watches, and selling them as such in English marked cases. He valued the Hall-mark as a guarantee of quality, and many cases were stamped with it for the American market.

Mr. **David Glasgow** would make the marking of watches optional. The fact that bad watches were put into Hall-marked cases and sold as English watches had a most prejudicial effect upon the reputation of our makers.

In going over the evidence of the various witnesses, we did not notice that any particular stress was laid on the complexity of the Hall-marking system, though this is an important source of objection. What with the variety of standards, and even the different marks for the same standard, the duty marks, the local marks, the varying date-letters, with a different system for each assay office, there is plenty of confusion and there are probably very few persons, even in the trade, who have a thorough acquaintance with all the English Hall-marks. We are decidedly of opinion that a voluntary Hall-mark would be beneficial to the trade and the public. The latter has, indeed, but a very vague notion of a genuine Hall-mark, so that the protection afforded amounts in reality to nothing. As soon as people are aware that they have to protect themselves they will be more scrupulous in making purchases and prefer to patronize legitimate tradesmen, whose name and reputation will offer them a certain guarantee. The honest trader would thus be benefited by the change, while the jeweller who has more copper than conscience, unable to cover his fraud by fictitious Hall-marks, would have a declining business. Let every dealer give a proper declaration to his customer of the articles sold, be they jewellery, plate, or watches, and that will be ample security for the buyer. Many a rascal would not mind selling a nine-carat article for a twelve-carat one, but he would hesitate before delivering a false, *written* declaration. Of course there is no system which is not liable to abuse, but we feel sure that there will be less imposture if free scope is given to individual reputations. America has no Hall-mark, and gets on very well without it. Is it because American jewellers are more honest than English ones?

(*To be continued.*)

FREE TRADE IN SILVER PLATE.

The following letter, which offers a striking example of the injurious effects of the silver plate duty to art progress, appeared in the columns of the *Sheffield and Rotherham Independent.*

To the Editor.—The hardworking silversmith in England has cause to be extremely grateful to Mr. Edward Watherston for his honest endeavours to release his trade from the bonds of so foolish a tax as that from which it suffers to-day.

Mr. Watherston truly observes that the tax is a hindrance to art in the silversmiths' trade. Such, sir, is the truth, which the following fact will show:—

I have in front of me, in my workshop, three old Wedgwood teapots, the designs of which I consider very beautiful, but I cannot possibly make these articles without sinking several pounds in duty; and, more important still, in the event of these articles, when made, not being quite so saleable as I expected, I cannot go to Goldsmiths' Hall, and say, "Here is my teapot. I thought it would be a success, but it is a failure. I canot sell it. Please return me the duty paid upon it." This, sir, is the hindrance which I think Mr. Watherston wishes to point out to the public.

In America, if a manufacturer should find after making any given piece of silver work, and after having given it a fair trial he has not the good fortune to sell it, he at once melts it, sacrificing the labour expended upon it, but I, an English manufacturer, must, under similar circumstances, melt the duty as well. Is this not a good reason why I hesitate to produce artistic teapots? I should not mind the loss of my time, but I am not rich enough to lose the money paid for duty as well as work.

I most heartily hope that when the Select Committee sit again they will bear in mind it is from poor working silversmiths that they are most likely to obtain facts, and not from rich manufacturers who can afford to leave matters to remain as they are.—I am, sir, yours obediently,

A STRUGGLING SILVERSMITH.

Sheffield, October, 1878.

My Uncle William (now deceased, alas!) used to say that a good horse was a good horse until it had run away once, and that a good watch was a good watch until the repairers got a chance at it. And he used to wonder what became of all the unsuccessful tinkers, and gunsmiths, and shoemakers, and blacksmiths; but nobody could ever tell him.—*Mark Twain.*

CURIOSITIES OF CLOCKS AND WATCHES.

(Continued from page 64.)

In June, 1826, the discovery was made of the *chef-d'œuvre* of Tompion, which had been so long lost. It was made for the Society for Philosophical Transactions, and was a year-going clock. A record exists which states that Tompion was at work on this clock when the great plague broke out in London, and on the day that he finished it he was attacked by the pestilence. His friends removed him to the Continent, where he died. On the dial was this inscription: "Sir James Moore caused this movement to be made with great care, Anno Domini 1676, by Thomas Tompion." Tompion was paid one hundred guineas, and the clock was removed to the Society's house, and there, in the confusion of the moment, it was placed in the lumber room, where it lay without a case exactly a century and a half. One thing wonderful attended this discovery, namely, that all the steel-pins on being cleaned from dust were found to be as brilliant as ever they had been. The above statement as to Tompion's death seems to be hardly consistent with the following advertisement, which appeared in *Mercator*, No. 7,921, 4 Nov. 1713:—"Advertisement. On the 20th instant, Mr. Tompion, noted for making all sorts of the best clocks and watches, departed this life. This is to certify to all persons, of whatever quality or distinction, that William Webster, at the 'Dial and Three Crowns,' in Exchange Alley, London, served his apprenticeship, and served as a journeyman a considerable time with the said Mr. Tompion, and by his industry and care is fully acquainted with his secrets in the said art."

Many curious clocks were made in the seventeenth century by Nicholas Grollier de Serviere, who was born at Lyons in 1596, where he died in 1689, after an eventful life. At the age of fourteen he was a soldier, and served in the army in Italy, and lost an eye at the siege of Verciel. He was also present at the battle of Prague, where he greatly distinguished himself. His knowledge of mathematics and mechanics enabled him to render much help to his country during the memorable sieges of the time of Louis XIV. After many adventures he retired from service, and found leisure to invent and manufacture many curious clocks and ingenious toys. In one of his clocks time was measured by the descent of a ball in a metal groove, twisted round columns supporting a dome. When the ball finished its descent, its weight lifting a detent, discharged the wheelwork, giving motion to an Archimedian screw, which raised the ball to its former position, again to descend as before. In another the ball descended in diagonal lines on an inclined plane. The means of ascent in this case were hidden from view. In a third the ball was made to pass within the body of two serpents, which by a reciprocating motion were made to swallow the ball alternately. A compound of the motions in the two last-named clocks was adopted by a scientific gentleman about fifty years ago, and timepieces on this principle are still called Congreve clocks after him. Grollier made several clocks for the purpose of pleasing and surprising his visitors. Thus a small figure of a tortoise dropped into a pewter plate filled with water, having the hours marked on the flat edge, would float round and stop at the proper hour. If moved, it would again return; and if the tail were placed at the hour it would turn round, and again point with its head. A lizard was seen ascending a pillar on which the hours of the day were marked, and pointing to the time as it advanced. The figure of a mouse was also made to move on a cornice, and point to the hours marked upon it. These contrivances were in part managed by concealed magnets, which were sufficiently strong to attract, although covered over. Grollier also contrived a method for showing the time at night, by causing the dial of a clock to revolve instead of the hands. By these means the hours and quarters were brought to an illuminated space and seen together; the quarters being differently marked, and engraven in a smaller circle than the hours. The inventor stated these clocks were less expensive and less liable to derangement than repeating clocks, and that none but the blind would prefer repeaters to them, it being easier to look at the one than to pull the cord of the other. Grollier made some clocks to go by their own weight, descending inclined planes, and others in grooves, forming a kind of path from the ceiling to the floor. When the clock had nearly finished its descent it was lifted off, and placed again at the highest point of its path, the hands being set to time before it was restarted. Several clocks on this principle have been projected to avoid the casualties to which main-springs and weight-lines are liable. Such a clock, invented and made by the Rev. Maurice Wheeler, was exhibited about eighty-five years ago at Don Saltero's museum of varieties at Chelsea, which was one of the popular sights of London at the close of the last century. One of these clocks, invented by M. de Gennes, was kept in equilibrium by a weight at the end of a lever. The unwinding of the springs made the weight change its position, thus altering the centre of gravity, and causing the clock to ascend the plane.

At a meeting of the Archæological Institute, held on February 6th, 1852, Mr. Forrest exhibited a travelling or table clock, in the form of a large watch, the date being about 1690, and the maker John Rehle, of Freiburg.

A curious satirical poem, published in 1690, and entitled, "Mundus Muliebris; or, the Ladies' Dressing-room unlocked and her Toilette Spread," mentions as part of a lady's paraphernalia:—

> "Repeating clocks, the hour to show
> When to the play 'tis time to go."

In 1696, William Derham, D.D., F.S.S., Canon of Windsor, and a most eminent philosopher and divine, who was born near Worcester in 1657, and died in 1735, published. "The Artificial Clockmaker; or, a Treatise of Watch and Clock Work; showing to the meanest capacities the art of calculating numbers to all sorts of movements, the way to alter clockwork, to make chimes, and set them to musical notes, and to calculate and correct the motion of pendulums. Also numbers for divers movements, with the ancient and modern history of clockwork, and many instruments, tables, and other matters never before published in any other book." This work was republished in 1700. A fourth edition, with large emendations, appeared in 1734, and another in 1759.

(To be continued.)

Bells for St. Paul's Cathedral.—The first instalment of the new peal of bells to be erected in St. Paul's Cathedral has already been placed in its proper position. Each of the twelve great bells have been cast at the foundry of Messrs. Taylor, of Loughborough. They bear also severally a suitable inscription and the arms of the donor. The roll of donors is mainly a list of some of the chief of the livery companies. The first and second bells have been presented by the Drapers' Company; the third, fourth, fifth, and sixth by the Baroness Burdett Coutts, and the Turners' Company, together; the seventh by the Salters'; the eighth by the Merchant Taylors'; the ninth by the Fishmongers'; the tenth by the Clothworkers'; the eleventh by the Grocers'; and the twelfth, the tenor, and the largest of the peal, by the Corporation. The total weight of the peal is between thirteen and fourteen tons.

Prices Current for Gold and Silver.—Value Given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver 4s. 6½d. to 4s. 9d. (variable according to quantity).

ARTIFICIAL DIAMONDS.

THE sons of the late Dr. Gannal, on looking over the documents left by their father, came across the draught of a paper which he had presented to the French Academy of Sciences, in 1828, on the subject of the artificial production of the diamond. This paper was referred to MM. Vauquelin and Chevreul, and nothing further was ever heard of it. The MM. Gannal now send the document to the Academy, believing it to be their duty to bring to light the now forgotten researches of their father.

It seems that in making some experiments with carbonet of sulphur, the idea occurred to Dr. Gannal that the carbon might be separated from it in crystalline form. He therefore took a certain quantity of the carbonet, poured a little water on the top of it, and then carefully introduced some stick phosphorus. The latter immediately dissolved, with the formation of three separate layers, phosphorus at the bottom, carbonet of sulphur in the middle, and water at the top. After a time he noticed that a sort of film was formed between the two latter layers, and that when exposed to sunlight it was indiscent. After the experiment had been in progress three months, a sudden fall in the temperature froze the water, split the glass, and the contents were thus lost. He again began his experiments, but as each one required six months to carry out, and as the numerous accidents to which they were liable continually interfered with their success, he finally abandoned his efforts. However, in the course of his experiments he had been able to procure some minute crystals, which he submitted to an eminent jeweller, who tested them by the microscope and other means, and decided that they had the true fire, water, and hardness of the diamond; moreover, on being subjected to the blowpipe, they left no ash. He concludes his memoir as follows:—"I believe that I can now announce that the greatest step is made toward the solution of the problem of making diamonds, in all respects similar to those nature has disseminated in India and Brazil." The complement of this discovery will do great honour to modern chemistry. The MM. Gannal call attention to the fact that there is no analogy whatever between the products obtained by their father and the pretended diamonds of M. Cagniard, of Latour, the latter being nothing more than silicates.—*Scientific American.*

Diamonds in China.—Mr. Fauvel, of Chefoo, communicates in the *North China Herald* some interesting facts concerning his researches into the mineral wealth of the district of Sha-tung, and the curious means of collecting small diamonds by the natives. "These diamonds," he says, "varying in size from a millet seed to a pin's head, are procured from the glaziers, who buy them at the large fairs held every year at Chüchow, Laichow-fu, and Hwang-hsien. They are not to be found in shops, and are packed in quills. The manner of finding these stones is very curious. Men with thick straw shoes on go walking about in the diamantiferous sands of the valleys, and streams of the diamond mountains, Chinkangling, some fifteen miles south-east of Yichow-fu. The diamonds, which are ragged and pointed, penetrate the straw, and remain there. The shoes are then collected in great numbers and burnt, the diamonds being searched for in the ashes. As is the case with ameythysts, and rock-crystal, in the Lao Shan, the priests of the temples in the Chinkang-ling are the principal dealers." Mr. Fauvel further mentions, that a diamond as large as a pea had been brought to Chefoo, and sold to a mandarin there.

Mons. Pierre-Frederic Ingold, a distinguished watchmaker, and intimately connected with the trade in England and the United States, died on October 18th at La Chaux-de-fonds, at the ripe age of ninety. At some future time we shall give a few biographical notes of this venerable horologist.

WATCHES AS PREMIUMS.

SOME months ago we read in one of our German contemporaries that a publishing firm in Germany wrote to a watch manufacturer, asking him to make a large quantity of watches to be given away as premiums with a book then in course of publication. A few of these watches were to be first-class time-keepers (of course, for show only), but the bulk, the ones really to be given away, merely shams of the former. Fortunately for the credit of the German watchmaking industry, the manufacturer instead of entertaining such an order, handed the document to the authorities, and the swindling publisher was arrested.

It appears, however, that there are some more fellows at large who wish to bless the public with cheap time. Watches have been advertised as premiums with American publications, and it may be assumed that the following advertisement, which appeared in the columns of a Swiss paper, originated with a rascal of the same class:—

"Wanted to buy, cheap, 200 silver cylinder watches, 18 lignes, adjusted and regulated, coloured dial, bearing the inscription: Half-chronometer, 22 rubies; 2,000 of the same sort, not adjusted and regulated. Address X. X.," &c.

There is no mistake about the intentions of this anonymous watch-dealer, and it is to be hoped that Swiss manufacturers will not lend themselves to such fradulent trading. What a refreshing impudence to sell a cylinder watch, with eight rubies at the most, for a half-chronometer with twenty-two! Not only is the public ignominiously cheated by such swindlers, but the business and reputation of respectable watchmakers is also seriously injured thereby; and as it is not all unlikely that similar practices may be attempted here, it would be well for the press to warn the public before hand. The trade has quite enough competition without the introduction of such illegitimate factors.

QUERIES AND ANSWERS.

M. S. C.—Can you inform me if any of the "Night Watches" alluded to in your October issue are in the market, and who is the manufacturer of the same?—We have not seen any of the watches you speak of as yet. The manufacturer is Mons. Fritz Ruesser, of La Chaux-de-Fonds, Switzerland.

Watchmaker.—Zinc rods for compensating pendulums are constructed either in solid castings or drawn hollow tubes. The ordinary casting in sand as practised by metal founders, will not answer for this purpose, as the soundness and solidity of castings in zinc cannot be relied upon. The only way of producing best possible cast rods for pendulums is by pouring the metal into a tube (of a somewhat larger diameter than the required rod, to allow for filing, turning, and finishing), made by bending and fitting a sheet of brass over an iron rod, and tying the same on several places with binding wire in such a manner as to allow in the joining a space of the thickness of a sheet of notepaper, which will permit the escape of the air whilst casting, and still prevent the metal from running through. The finishing will be best accomplished with a hollow semi. circular file made for the purpose, as the turning of a long zinc rod is rather a tedious job. The polishing is effected by first smoothing with emery-paper, and then finishing with felt or any other mode of polishing. The pivots are best made by turning, but may also be done with a sharp flat file.

The hollow tubes are made of sheet zinc of a thickness corresponding with the diameter of the desired rod, drawn through a draw-plate. The manufacture of such rods will have to be entrusted to a wire-drawer, as the necessary appliances and the requisite experience for such a process are not generally at command in an ordinary watch and clockmaker's shop. The drawn tubes are at any rate preferable to the cast rods, as they come out smooth without further manipulation, and being hollow, ends can be inserted to act as pivots.—H. Bush.

THE PLACE OF JEWELLERY IN ART.

A Paper read at the Social Science Congress, Cheltenham.

By Edward J. Watherston,
Member of the Society of Arts.

It is a very singular fact that among the many efforts made in modern times to elevate the feeling of true art, and to spread a knowledge of it through all classes, one feature of the great subject, presumably interesting to most persons, should have been almost entirely overlooked. It is that art in dress includes art in the use of what is generally called jewellery, or personal ornaments, whether in gold, silver, or precious stones. Jewellery is not only a part of dress, or costume, but it is older than any other form of apparel. To this day a negress will be content to put a bracelet around her arm, or a necklace over her bosom, before she thinks of any other garment for her body. To her the ornament is the real dress—that is, a means of either adding artificial to natural charms or of compensating for the absence of the latter. And so it was, probably, from the beginning. The bit of ornament, the necklace, the ring, the bracelet, was chosen with the object of adding to personal beauty, and was most carefully chosen, with a sort of instinctive feeling for symmetry. That natural instinct certainly is gone in modern times, and art has not filled the place. A lady will consult assiduously a milliner as to the form of bonnet most becoming to her, or a dressmaker as to the most befitting robe. But whenever was a lady heard to consult a jeweller as regards her earrings, bracelet, or necklace? It is the mere money value that attracts, almost invariably, and the fitness of the special ornament to the person intended to wear it is very nearly the last consideration. Yet this is clearly barbarism in art. What would be said of a beautiful woman hanging a string of sovereigns, or, better still, a roll of hundred-pound Bank of England notes around her arm or neck? But this is exactly what is happening now, in the absence of all art instruction on the subject. A lady to whom rubies are most becoming will wear emerald or turquoise ornaments, regardless of the colour of her dress; another will insist on decorating herself with gold, while silver would be the most suitable. So, too, as regards the shape of personal ornaments. A tight-fitting bracelet is put on a stout wrist, to make it look larger than it actually is; and a loose one placed over a thin arm, to make it appear still more slender. Of course the ladies, after all, must not be blamed, but the absence of teachers. They themselves are the greatest sufferers from the "blind and naked ignorance" in respect to the use of personal ornaments, as a part of costume to be carefully selected so as to be most becoming the individual.

To the Greeks, "our masters in art," we must look, as in many other things, also as to the most befitting use of jewellery and all personal ornaments. The Greeks, and to some extent likewise their art pupils, the Romans, exhibited their innate feeling for symmetry and beauty in this respect in that they made the head, the noblest part of the human form, the chief object of decoration. Nothing can be more exquisitely beautiful than the golden ornaments on the heads of some of the gods and goddesses of Greece. To refer only to some universally known statues of antiquity, such as those of Cybele, Flora, and Diana, we see at a glance that a great part of the wonderful grace and beauty of the figures is due to the head ornaments. Cybele, without her mural crown, would not worthily represent the august "mother of the gods"; neither Flora, without her hair-woven garland, the goddess of flowers; nor would Diana, without her lustrous diadem, stand forth so grandly as the universally-worshipped daughter of Jupiter, herself threefold a goddess:

Terret, lustrat, agit, Proserpina, Luna, Diana,
Ima, suprema, feras, sceptro, fulgore, sagitta.*

It is well-known that Greek and Roman ladies wore no bonnets or hats, except occasionally as a protection against sun and rain: exactly for the same purpose our modern ladies use parasols and umbrellas. In fact, the bonnet, or hat, in no way formed part of the general costume, and, if it has become such in more modern times, it must be regarded as simply an aberration of taste. Perhaps this may be said to be an unconscious groping after old ideals that have been lost. In reality, all changes of fashions, or what the French call "la mode," express this kind of blind, unconscious search after the beautiful. At one time ladies will encase themselves in dresses clinging tightly to the figure, and the next will be an expansion of outer garments into the hugest dimensions. It is, in fact, action and reaction: the rise and fall of the tidal wave. Possibly, some Mr. Spottiswoode may discover one day the mathematical laws of fashion.

An important part of the ornaments for the head used by the Greeks and Romans still survives to this day, namely, earrings. But it survives in a very attenuated and altogether inartistic form. It is certain that "our masters in art" employed eardrops, as they did all other personal adornments, with a strict view to proportion and symmetry. They would not have dreamt of enclosing a full, round face by broad ear-pendants, nor of setting deep-coloured rubies, or corals, around features of dark complexion. Least of all would they have dreamt of shaping such monstrosities, as the majority that are made nowadays, to hang against the face of a beautiful woman, in the shape of earrings. The contrast between our productions at this day and ancient Greek art is almost painful. To examine the magnificent specimens of "inaures" at South Kensington and the British Museum—the latter collection, unfortunately, still in an embyro state at present, but nevertheless of good promise, with its coming additions—and then to walk forth into the London streets, to behold in the shop-windows the similar productions of modern art, is afflicting indeed. It seems as if all art had vanished, to give place to the most vulgar and gaudy tastelessness. One thing altogether forgotten in the use of ear-pendants is that they constitute an important ornament in regard to the movements of the figure. If the body moves, they too should swing in graceful, harmonious curves, and if at rest their function is to add in quietness to the beauty of the outlines of the head. All this the Greek and Roman ear ornaments did, while our own mostly are mere lumps of metals, or stones, clapped to the sides of the face, without the slightest regard to the form and colour of the latter. With a perverseness that is really singular, and often not a little comical, it generally happens that, in the selection of the modern "inaures," ladies generally pick out what suits them least—corals being chosen by those who want pearls, and broad eardrops by those who want the narrowest. However, this is but on a par with all the rest. The beautiful garland of Ceres has grown into a Red Indian feather-bonnet, and the starry diadem on the front of Diana has found its way to the back of the head, where it appears as that ugliest of all ugly things—a comb.

(*To be continued.*)

The School of Horology in Geneva was frequented by 67 pupils during the school year of 1877-78, 44 of which were Genevese, 9 Swiss of other cantons, 8 French, 2 English, 1 German, 1 Russian, 1 Portuguese and 1 Brazilian.

The Turners' Company's Silver Medal offered for the best going barrel and stop work was withheld, none of the specimens sent in being of sufficient merit.

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* "As Proserpine below, as the Moon on high, and as Diana, she frightens, surveys, and drives the wild beasts with her sceptre, her brightness, and her arrow."

THE

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Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at Milners' Buildings, Moorgate Street (Opposite Moorgate Street Station), London, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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PATENTS.

Applications for Letters Patent.

4536. Joseph Tranter, of Birmingham, in the county of Warwick, Jeweller, for an invention of "Improvements in fastenings for bracelets, necklets, scarf rings, and lockets."—Dated 8th November, 1878.

4674. Auguste Lion, Jeweller, of the city of Paris, in the Republic of France, for an invention of "Improvements in bracelets, necklets, and chains, and in their mode of manufacture."—Dated 18th November, 1878.

Patents Sealed.

1801. John Guy Wilson, of the city of Manchester, Mechanical Engineer and Patent Agent, for an invention of "A new or improved billiard table detector clock."—A communication to him from abroad by Edward Pfitzner, of Breslau, in the empire of Germany.—Dated 4th May, 1878.

2467. Charles Shepherd, of Alexandra Road, Saint John's Wood, in the county of Middlesex, for an invention of "Improvements in electro-magnetic clocks."—Dated 20th June, 1878.

1840. George Lund, of the firm of Lund and Blockley, of 42, Pall Mall, in the city of Westminster, Manufacturers, for an invention of "Improvements in apparatus for synchronizing or setting clocks or other time-keepers."—Dated 8th May, 1878.

2283. Daniel Azro Ashley Buck, of Worcester, in the county of Worcester and state of Massachusetts, in the United States of America, for an invention of "Improvements in watches."—Dated 7th June, 1878.

2441. Louis Auguste-Grosclaude, of Genève (Suisse), Manufacturer, for an invention of "An improved click and spring work."'—Dated 19th June, 1878.

Notices to Proceed.

3067. Max Tuteur, of Hatton Garden, in the county of Middlesex, Manufacturing Wholesale Jeweller, has given notice in respect of the invention of "A new or improved fastening for lockets, watches, bags, and other articles."

4007. Raphael Hunter Brandon, Engineer and Patent Agent, of 38, Southampton Buildings, London, and 1, Rue Laffitte, Paris, has given notice in respect of the invention of "Improvements in the mechanism and the working of electric clocks."—A communication to him from Charles William Firnhaber, a person resident in Paris, Rue Laffitte, 1.

2924. Thomas Mills, of Oldham, in the county of Lancaster, has given notice in respect of the invention of "Improvements in watches."

Patents which have become Void.

3662. William Jephcott, of Birmingham, in the county of Warwick, Watchmaker, for an invention of "Improvements in the cases of watches, clocks, timepieces, lockets, and other similar articles."—Dated 21st October, 1875.

3677. William Robert Lake, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, for an invention of "An improved diamond-holder, and method of inserting, fitting, and securing diamonds in metallic holders."—A communication to him from abroad by Joseph Wild Branch, of St. Louis, Missouri, United States of America, Manufacturer.—Dated 22nd October, 1875.

Grants of Provisional Protection for Six Months.

4007. To Raphael Hunter Brandon, Engineer and Patent Agent, of 38, Southampton Buildings, London, and 1, Rue Laffitte, Paris, for the invention of "Improvements in the mechanism and the working of electric clocks."—A communication to him from Charles William Firnhaber, a person resident in Paris, Rue Laffitte, 1.

4090. To Thomas Wallen, of Coventry, in the county of Warwick, Watch Manufacturer, for the invention of "Certain improvements in keyless watches."

4067. To Frank Wirth, of the firm of Wirth and Company, Patent Solicitors, at Frankfort-on-the-Maine, in the empire of Germany, for the invention of "Improvements in calendar clocks."—A communication from Theodor Weisser, a person resident at Furtwangen, in the Grand-Duchy of Baden.

4069. To Thomas Winkles and Thomas Moxon, both of Birmingham, in the county of Warwick, for the invention of "Certain improvements in swivels for securing watches to their chains, also applicable to other analogous purposes."

Patents Granted in Foreign States.

UNITED STATES OF AMERICA.

207,609. Frederic A. Lane, of New Haven, Conn., assignor of one-half of his right to Paschal Converse, of the same place, for "pendulums."—Application filed 19th August, 1878.

46,421. C. Andrieux, for "A tremolo clock-work with a remontoir for continuous action."—Dated 21st October, 1878.

46,424. E. J. Levavasseur, for "A chain for jewellery."—Dated 21st October, 1878.—French Patent, 9th April, 1878.

208,182. Dyer T. Kendrick, of Boston, Mass., for "Combined calendar-dial and watch crystal."—Application filed 10th June, 1878.

208,216. J. Hart Welch, of Hartford, Conn., for "Clock-cases."—Application filed 22nd August, 1878.

208,230. George H. Fuller, of Pawtucket, R.I., for "Manufacture of jewellers' findings."—Application filed 24th June, 1878.

208,238. Hein H. Heinrich, of New York, N.Y., for "Self-adjusting balances for chronometers."—Application filed 2nd April, 1878.

208,478. Charles Maynard, of Boston, Mass., for "Illuminated clocks."—Application filed 13th July, 1878.

208,563. Martin Bock, of Hughesville (Drum's P.O.), Pa., for "Clock cases."—Application filed 1st August, 1878.

208,480. William D. McGloghlon, of London, Ontario, Canada, for "Watch-pendants."—Application filed 9th January, 1878.

AUSTRIA.

30. H. Herzka, of Vienna, for "A construction of pendants."—Dated 28th August, 1878.—Class 7.

1. H. Herzka, of Vienna, for "A construction of studs."—Dated 28th August, 1878.—Class 1.

FRANCE.

123,588. Gross, for "A bracelet fastener."—Dated 2nd April, 1878.—Class 17.

123,591. Prochnik and Daudergnies, for "An alarm-clock or waker."—Dated 2nd April, 1878.—Class 12.

123,621. Bontems, for "A circular escapement-pendulum with a jointed anchor for clock-work."—Dated 3rd April, 1878.—Class 12.

123,720. Levavasseur, of Paris, for "Mounting chains for jewellery."—Dated 9th April, 1878.—Class 17.

123,770. Bates, for "Improvements in setting diamonds."—Dated 10th April, 1878.—Class 17.

123,877. Schwob, for "A so-called 'momento-watch.'"—Dated 15th April, 1878.—Class 12.

123,949. Deschiens, of Nancy, for "Improvements in his optical instrument for measuring the power of vision, called 'opsimeter.'"—Dated 1st May, 1878.—Class 12.—Original Patent, 18th October, 1866.

123,984. Potuau, for "Improvements in the manufacture of watches."—Dated 19th April, 1878.—Class 12.

123,993. Hodel, of Bordeaux, for "A metallic safety valve with a double spring and vulcanized caoutchouc dial for watches, chronometers, &c."—Dated 3rd May, 1878.—Class 12.

124,013. Hipp, for "Improvements in electric clocks."—Dated 20th April, 1878.—Class 12.

124,035. Robert, for "Improvements in second-counters, applicable also to watch-counters."—Dated 23rd April, 1878.—Class 12.

124,039. Gresset, for "A cosmographic apparatus applicable to clocks, especially pendulum-clocks."—Dated 3rd May, 1878.—Class 12.

124,040. Hegemann, for "Gearings with hollowed pinions and applying the same in industry and clock-work."—Dated 4th May, 1878.—Class 12.

124,046. Drugeon, for "A mechanism applicable to clock-work in general."—Dated 24th April, 1878.—Class 12.

124,057. Baron, for "A bracelet that can be used as a brooch, bracelet, stomacher, or head-dress."—Dated 28th March, 1878.—Class 17.

124,147. Monot and Son, Stumpf, and Co., for "A hot process of applying a layer of gold or other metal on glass or crystal.' '—Dated 27th April, 1878.—Class 13.

BELGIUM.

46541. B. S. Church, for "A pedometer."—Dated 7th November, 1878. French Patent, 4th November, 1878.

46,542. F. Perillat, for "Applying aneroid barometers to jewellery."—Dated 7th November, 1878.—French Patent, 28th June, 1878.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Perry, Jno. Cotterell, Park Road, Knowle Park, Totterdown, Bristol, working silversmith. Nov. 2. F. W. Tonkin, sol., Bristol.

Hammond, Robt.'Bills and Wm. Hammond, tdg. as R. B. Hammond and Sons, 9, Horsefair, Birmingham, jewellers. Nov. 2. Sargent and Son, sols., 12, Bennett's Hill, Birmingham.

Caporn, Wm. Pears, 11, Upper Well Street, Coventry, watch manufacturer. Nov. 1. T. Brewett, sol., Coventry.

Campbell, Fredk., 133, New Bond Street and Victoria House, Highgate Hill, jeweller. Oct. 29. A. C. Lewis, sol., 7, Furnival's Inn.

Lowe, Jno., 12, Southampton Street, Strand, watch manufacturer and jeweller. A. T. Smith, sol., Selbourne Chambers, Chancery Lane.

White, Thos. and Fredk. Campbell, 133, New Bond Street, goldsmith. Oct. 29. A. C. Lewis, sol., 7, Furnival's Inn.

White, Thomas, 133, New Bond Street, goldsmith. Oct. 29. A. C. Lewis, sol., 7, Furnival's Inn.

Pulcifer, Ebenezer, St. James St., late Long Row, Market Place, both Nottingham, watchmaker and jeweller. Nov. 11. W. H. Stevenson, sol., Nottingham.

Balmforth, Richard Marsden, Westgate, Elland, Halifax, jeweller. Nov. 12. J. L. Garsed, sol., Halifax.

Diaper, Jas. Stowmarket, Suffolk, silversmith. Nov. 9. J. Gudgeon, sol.

Thompson, Elijah, 31, Sunderland Terrace, New Clee, Lincolnshire, jeweller. Nov. 16. A. A. Watts, sol., Great Grimsby.

Hiron, Wm. Hy., Chipping Campden, Gloucestershire, late St. Paul's Sq., Birmingham, jeweller. Nov. 11. G. Crosby, sol., Banbury.

Phipps, Alfred Jas., 8, Carlton Bridge Terrace and 105A Golborne Road, Westbourne Park, watchmaker. Nov. 16. T. Sampson, sol., 252, Marylebone Road.

Shepherdson, George E., Newport Road, Middlesborough, watchmaker and jeweller. Nov. 8. R. J. Parr, sol., Colmore Row, Birmingham.

Gianni, Trinnette Fagniot and Angelo Gianni, trdg. as T. and A. Gianni Alnwick, jewellers. Nov. 20. At Queen's Hotel Birmingham. Dec. 10 at 11. Foster and Paynter, sols., Alnwick.

Gianni, Angello, Alnwick, jeweller (sep. crdtrs). Nov. 20. At Queen's Hotel, Birmingham, Dec. 10 at 12½. Forster & Paynter, sols., Alnwick.

Gianni, Trinnette Fagniot, Alnwick, jeweller (sep. crdtrs.) Nov. 21. At Queen's Hotel, Birmingham, Dec. 10 at 12. Forster & Paynter, sols., Alnwick.

Brownhill, Jas., 41, Upper Parliament Street, and Prussia Street, both Liverpool, watchmaker and jeweller. Nov. 19. Yates, Son and Stananought, sols., 10, Water Street, Liverpool.

Kaufman, Jsph. Dvd., Salem Street South, Sunderland, jeweller. Nov. 21. Hines & Sons, sols., Sunderland, Dec. 12 at 11. A. Hines, sol.

North, Frdk., 49, Sussex Street, Lower Broughton, Manchester, working jeweller. Nov. 19. R. Welsh, sol., Huddersfield, Dec. 7 at 2.

Whateley, John, jun., High Street, Aston New Town, near Birmingham, designer, late Warston Parade, Birmingham, manufacturing jeweller. Nov. 20. E. Eaden, sol., Bennett's Hill, Birmingham, Dec. 5 at 11.

Dividends.

Boyall, Joseph (Liq.), Spilsby, Lincolnshire, jeweller. 1st div. 3s.; F. B. Leeming, 10, Coleman Court.

Adjudications of Bankruptcy.

Lecomber, John, Slater Street and Duke Street, both Liverpool, watch manufacturer. Nov. 7. Bellringer, Reg.

Trustees Appointed.

Hertzberg, Julius (Liq.), Englefield Road, Islington, late Bishopsgate Street, Within, jeweller. Tr., J. Seear, 105, Cheapside, accountant.

Payne, Wm. (Liq.), Queen Victoria Street, and Highbury New Park, jeweller. Tr., S. B. Webber, 30, Poland Street, Oxford Street, jeweller, and M. Banes, 22, Basinghall Street, accountant.

Davis, Frank I. (Liq.), Warstone Lane, Birmingham, jewellers' factor. Clms. by Nov. 23 to S. Dominy, Waterloo Street, Birmingham, accountant.

Skinner, Wm. (Liq.), Vyse Street, Birmingham, jeweller. Clms. by Nov. 16 to G. Hill, Temple Street, Birmingham, accountant.

Sheraton, John (Liq.), Newcastle, jeweller. Tr., R. Ormond, Newcastle, accountant.

Burroughs, John (Liq.), Welshpool, watchmaker. Clms. by Nov. 20 to F. Roper, Broad Street, Welshpool, accountant.

Dissolutions of Partnerships.

Dowler and Smith, Cherry Street, Birmingham, gilt and plated jewellers. Sept. 30.

Evans, Samuel, and Sons, Great Hampton Street, Birmingham, electro plate manufacturers. Sept. 28.

Russell, Thomas, and Son, Church Street, Liverpool, watch manufacturers. July 1. Debts by Thos. R. Russell.

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Expedition; BERLIN, W. MARKGRAFENSTRASSE, No. 48.
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AWARDS TO FOREIGN WATCHMAKERS AT THE PARIS EXHIBITION.

FRANCE and Switzerland, both extensively and worthily represented in the horological section at the late International, have justly shared the bulk of the awards in this department between them.

To France have been awarded, besides a diploma of honour for the Collectif Exhibition of the Department du Doubs, a grand prize for Messrs. Japy Frères et Cie., and nine gold medals for—

Messrs. E. Brown, Paris.
A. F. Collin, Paris.
G. C. Desfontaines, Paris.
L. Fernier et Frères, Besancon.
P. Garnier, Paris.
M. T. Leroy, Paris.
Montandon Père et Fils, Paris.
C. L. M. Requier, Paris.
Société Jean Blanc et Cie, Besancon.

Thirty-four silver medals, 75 bronze medals, and 106 honourable mentions.

Switzerland carried off a diploma of honour for its Collectif Exhibition. Also nine gold medals for—

Messrs. L. Audemars, Geneva and Brassus.
J. M. Badollet et Cie., Geneva.
Borel et Courvoisier, Neuchatel.
H. R. Ekegrèn, Geneva.
Dr. Hipp, Neuchatel.
E. Francillon, St. Imier.
H. Grandjean et Cie., Locle.
J. Nardin, Locle.
Patek, Philippe, et Cie., Geneva.

Thirty-five silver medals, 52 bronze medals, and 34 honourable mentions.

Austro-Hungary, two silver medals, six bronze medals, two honourable mentions.
Denmark, one silver medal and two bronze medals.
Sweden, one silver medal and one bronze medal.
Spain, one silver medal
Italy, two bronze medals and two honourable mentions.
Belgium, one bronze medal and one honourable mention.
Russia, two honourable mentions.
Netherlands, one honourable mention.

MAYORAL COLLAR AND BADGE.

WE have already had occasion to allude to the high-class civic jewellery which Messrs. J. R. Williams and Son, of 108, Hatton Garden, are capable of producing, and which has earned them an unrivalled reputation for this kind of work. Since they manufactured the magnificent chain for the Mayor of Liverpool, at a cost of £1,500, we do not recollect to have seen a finer piece of work in their establishment than the collar and badge made to the order of Messrs. Bell and Atkinson, of Lancaster, for the mayor of that ancient city.

The centre of the collar is formed by the red rose of Lancaster, modelled and enamelled in proper heraldic colours. Next to it is a solid portcullis, then a beautifully modelled and chased lion, followed by the S's of Lancaster, combined with the shield of John of Gaunt, also richly enamelled with the heraldic devices. The other half of the chain, starting again from the red rose in the centre, is formed of the S's, the shield of the city arms, the knot and fleur-de-lis, being part of the city crest, and the rose of Lancaster again in solid gold. The whole of these emblems are repeated about four times, and form thus a splendid gold collar nearly four feet long. The emblems are connected in two places by solid patent cable and oval links. The badge, also an exquisite specimen of goldsmith's work, represents the arms of the city. On the centre shield (Norman), which is red and blue, is a beautifully modelled lion and fleur-de-lis, above this the knight's helmet; the mantling and the larger fleur-de-lis form the loop. The border up to the mantling is formed of laurel leaves, the sword and mace, and a ribbon bearing the words, "Burgus Lancastrie, A.D. 1188." On the back is the following inscription :—" Presented by Councillor S. W. Wearing to the Corporation of Lancaster, as a token of his pleasant connection with that body, A.D. 1878. Adam Seward, Esq., Mayor."

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Translated by JULIEN TRIPPLIN, Besançon Watch Manufacturer, and EDWARD RIGG, M.A., Assayer in the Royal Mint.

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JOURNAL.
W H TILBY

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

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HOROLOGY.

(*Continued from page* 72.)

XXXVIII.—Isochronal Adjustment of Balance Springs.

Of all the adjustments necessary in the parts of a good watch, the most essential to its performance is unquestionably that of isochronism of the balance spring; for if this adjustment is wanting, whatever may be the excellence of the mechanism in other respects, and however laboured its workmanship and other adjustments, it will assuredly disappoint the expectation of the maker, who will find it impossible of being regulated to preserve the same rate of going in the various positions in which it is liable to be placed.

Suppose, for instance, that by comparison with a reliable regulator the going of a well-made watch is right during twelve hours in four vertical positions, where the friction is greatest, and the arc of vibration of the balance considerably diminished in extent (the positions being with the hours 12, 6, 9 and 3 upwards during 3 hours each), and that it keeps correct time in all these positions, but that in the horizontal position, or with its face upwards, with larger arcs of vibration, the watch gains one hundred and twenty seconds in twelve hours, the friction being lost in the horizontal positions, and consequently the arcs of vibration of greater extent. The proper remedy in such a case is to make a correct isochronal adjustment of the balance spring. A person unacquainted with the adjustment would, however, fail to discover what the true remedy would be, and would follow the plan usually resorted to, in which, by lightening the balance at the twelve o'clock part, the times of the vibrations in the hanging and lying position would be accommodated to each other, but not without increasing in the other three vertical positions, to the great detriment of a nearly perfect watch. Thus it is that many watches, which are fair specimens of workmanship, are frequently injured by false adjustments, and fail to preserve for their makers either credit or satisfaction.

Isochronism is an inherent property of the balance spring, depending entirely upon the ratio of the springs' tension following the proportion of the arcs of vibration. A balance spring, therefore, of any force whatever, having the momentum required by the law of isochronism, will preserve this property, whether it be applied to a balance having quick or slow vibrations; for which reason, in the present inquiry, every consideration is purposely omitted which gives to the balance its specific character—such as weight, diameter, etc., etc., and it is treated simply as the balance.

Most writers on isochronism consider the vibrations of the balance in its totality, and they have reasoned for the most part on the time of vibrations in their entirety; but a better plan would be to consider the time of each semi-vibration of the balance to consist of some number of minute equal portions of time, and then, by applying the known laws of forces to the balance to determine what are the specific conditions under which the vibrations themselves shall in their totality become isochronous. The elastic force of the spring belongs to that class of powers called continuous, because the action is not by a single impulse, which then ceases, but by a number of consecutive impulses following each other in such rapid succession as to constitute an uninterrupted and continuous force, but which force is uniformly increasing during the bending of the spring, and uniformly decreasing during its unbending.

The first step towards the comprehension of isochronism is the recognition of the accelerated and retarded motion of the balance; for which purpose it must be followed, step by step, through the entire vibration, on the supposition that the time of each semi-vibration is divided into or composed of any convenient number of equal parts—say ten. If, then, the balance be supposed to be moved by the fingers from the point where it will stand when at rest, over an arc of any number of degrees, and be there held, it will be presumed that the spring is wound into tension, and acquires an amount of elastic force proportionate to the angle over which it is inflected, which force is then resting against the finger by which the balance itself is held in a state of rest. By the arc or angle of inflection of a spring is meant the arc passed over by the inner end of the spring, which is pinned into the collet; which arc is always equal to that passed over by every point in the balance when moved from the point of rest. The instant, however, that the finger is withdrawn, the elastic force of the spring will be exerted in overcoming the absolute inertia of the balance, and at the expiration of the first short period of time, or one-tenth of the time of a semi-vibration, the spring will have communicated a slight motion to the balance, and during the second tenth the force of the spring is exerted against the balance in motion, instead of at rest, as it was at the commencement of the first tenth, and will necessarily accelerate the motion that the balance had previously acquired, and so on during each succeeding tenth; the elastic force of the spring continually decreasing, and constantly accelerating the motion of the balance. The balance having thus returned to the position from which it was moved by the finger, the first half of the vibration is fully completed, and a change of circumstances takes place. The spring which continued to communicate motion to the balance until its whole force had been transferred to it, has now, for an instant, resumed a state of rest. The balance has also assumed a new character, having acquired a velocity of motion and momentum sufficient to carry it through the other half of the vibration; and in so doing to force the spring through an angle equal to that which it was originally moved through by the finger, and to give the spring the necessary tension for performing the next succeeding vibration. During the first few tenths of the second half of the vibration the spring has so little tension that its force retards but slightly the force of the balance; but during the succeeding tenths the tension gradually increases until the spring acquires sufficient force to entirely arrest the motion of the balance at the same extent or arc on the other side of the place of rest as that to which it was originally moved by the finger. The specific conditions under which the vibrations themselves, considered in their entirety, whether short or long, should be isochronous, are these:

1st. If the time of each semi-vibration be conceived to be composed of the same number of very small equal instants of time, and whatever be the extent of the arc traversed, that the first and last of these minute instants of time precisely compared with the commencement and conclusion of each semi-vibration, the vibrations of such balance, whether long or short, will be isochronous—or performed in equal time.

2nd.—The elastic force of the balance spring increases in direct proportion to the angle of inflection by which it is moved into tension; and here it is obvious that the increasing and diminishing tension which causes the balance to follow a definite law of acceleration and retardation, must itself also follow a definite ratio of increase and decrease in order that the first and last of these very small equal instants of time shall correspond with the commencement and conclusion of each semi-vibration.

3rd.—It is likewise evident that the ratio of change in the tension may be either one that proceeds too rapidly, and consequently produces a vibration in excess, or one which proceeds too slowly and produces a vibration too short; on which account there are two vibrations of the spring which are not isochronous.

4th.—In the former variety producing a vibration in excess, the spring acquires a greater amount of elastic force than that which is due to the angle of inflection in an isochronal spring; hence it follows that the greater the arc of vibration the greater will be the angles of inflection, and consequently the greater the excess of the undue tension. The effect of this undue tension will be to force the balance forward too quickly during the first half of the vibration, causing it to arrive at its conclusion before the expiration of the time due to the isochronous vibration. A similar effect is produced during the second half of the vibration by the undue excess of tension accelerating the balance before the full number of instants of time have entirely expired. During each semi-vibration throughout the day some of these minute instants of time will be left unemployed, and their accumulated amount will be the amount gained in the long arcs of vibration, in comparison with the same in the short arcs.

5th.—In the latter variety the elastic force due to the angle of inflection will not be sufficiently great, and the spring will not have requisite tension to carry the balance over the first semi-vibration of a long arc in the time allotted to it, nor to arrest it so soon as the isochronous term of the second semi-vibration requires. Each semi-vibration, therefore, will occupy too large a number of instants in its performance, and the accumulated amount of them throughout the day will indicate the loss during the long arcs of vibration in comparison with the short arcs.

(*To be continued.*)

ALUMINUM AND PLATINUM IN THE MANUFACTURE OF WATCHES.

IN ordinary watches their correctness depends greatly on their position, whether this be a vertical or horizontal one. The reason is, that the more rapidly rotating wheels principally, but more or less all of them, are made of too heavy material. Brass, or a similar composition, is, as a rule, too heavy, and, as an immediate consequence, it will not be immaterial whether a wheel presses with its full weight vertically upon the axis (that is, rests on the point of it), or whether the pressure of its weight is exerted on the circumference of the axis. The latter is naturally the more correct position, insuring a correct, even an unchanged movement of the watch. Hence the steady desire to keep the watch in an upright position. The influence of changed position will be much less felt, especially of that of the more rapidly rotating wheels, if these are made of the thrice lighter aluminum instead of brass. Used for that purpose aluminium constitutes an important improvement, since the position then becomes a matter of no influence on the movement of the watch. The friction, and therefore the wear of the wheels is reduced, and oiling may often be dispensed with.

Platinum, however, by its heaviness, is indicated for the manufacture of balances, as they become thereby more independent of exterior shocks.—*Schweizerische Gewerbe-Blatt.*

HALL-MARKING AND DUTY QUESTION.

(*Concluded from page* 78.)

Mr. JAMES GORDON WILSON, a member of the deputation of watch-case makers and watch manufacturers, which waited on Sir Charles Adderley early in the past year, stated on that occasion that about 150 years ago it was made impossible for English manufacturers or dealers either to make or sell watch-cases without Hall-marks, the penalty attaching to the making of a case without the Hall-mark being £50 and for selling £10; and the result of this enactment was that the making of cheaper watches, especially during the last fifty years, had fallen into the hands of foreigners, as a shopkeeper could sell foreign watches without any Hall-mark. If that is the case, it would have been better to abolish the Hall-mark on English watches, and to keep the trade of the cheaper grades in the land.

The forging of English names on foreign watches, and the selling of them as English, is certainly a grievous injury to the English maker, and no effort should be spared in putting down such fraudulent practices. By giving a monopoly to the watch-case makers such a desirable end could, however, not be gained. The latter would certainly get rid of his grievance, but it would not settle the much harder case of the movement maker, since foreign movements could still be put into English-made cases. The movement is the most valuable part of a watch and not the case; and by protecting the latter only the fraud which most seriously affects the reputation of English watchmakers would still remain.

There is no doubt that the public generally believe a hall-marked case to contain our English movement; but it should be disabused of such an opinion—in fact, the sooner the public is a little more educated on the subject of clocks and watches the better it will be for the trade and the public. Much of the fraud practised is, indeed, based on the people's ignorance of the subject. The suggestion made by Mr. S. Jackson for English manufacturers to stamp their movements with a registered trade-mark, the forging of which has become penal by recent legislation, deserves attention, and we think that its application would do much towards lessening the evil. Some will say that trade-marks will be forged also. Granted—black sheep will always exist; but when a case of the sort comes to the knowledge of a maker, he should vigorously prosecute the culprit and make a deterrent example of him. Why does not the trade combine? There are many objects of vital interests to all which can only be obtained by united action. Other trades have their mutual protection societies, why not the watch and precious metal trades? A small subscription by each member of the trade would suffice to prosecute common enemies, and to obtain such advantages as individual exertions cannot bestow.

In conclusion we may state that the Horological Institute, at a meeting of the Council, held June 17th, adopted unanimously the following resolutions relative to the Hall-marking of watch cases:

That the Hall-mark of the Goldsmiths' Company has not been regarded by the trade as a trade-mark for watches.

That the pretext of declaring the Hall-mark to be a trade-mark would give to one section of the watch trade a monopoly at the cost of all the rest. The proportion of labour in the production of a watch may be divided into one-tenth for the case and nine-tenths for the works.

The interchange of parts of watches between English and foreign manufacturers is already sufficiently extensive that any restriction would greatly impede the watch trade in this country.

The proposed restriction would stop the production of a branch of the manufacture where the movements are of a complicated character, and wholly or partly of foreign manufacture, to which now English cases are applied.

That the suppression of fraud on the public by the substitution of foreign watches for English, would not be effected by the proposed Bill, inasmuch as foreign movements could still be put into English-made cases by the unscrupulous.

SWISS OPINION OF ENGLISH WATCHES.

THE *Times* Geneva correspondent writes:—"The *Journal de Genève* has been publishing a series of elaborate articles on the horological displays of the late Paris Exhibition, from the pen of M. Adrien Philippe, a well-known expert. This gentleman's opinion on the English watches shown at the Exhibition may not be without interest for English readers. Mons. Philippe says:—'The reflection is forced on us that English watchmaking remains absolutely stationary—at least so far as regards pocket watches. The English watch is almost the same now as fifty years since; there is, perhaps, a slight alteration in the size of the barrel (*fusée*) to accommodate it to the stem winding movement, but the calibres, the escapements, and the ways of working are always the same. We can only suppose that English watchmakers believe they have reached perfection, or that they are so far on the way towards it that they can afford to despise the efforts of their rivals to overtake them. Be it so, *Messieurs les Anglais*; sleep on in this happy tranquillity of spirit; you have a sufficiency of other industries in which your engineers, your inventors, and your intelligent workmen may find ample scope for their activity; you may well afford to leave one field open to competitors less favourably situated. Switzerland will not complain, neither probably will America, that England makes so slight exertion to preserve the markets where her ancient reputation might still, perhaps, give her the preference if she would only take the trouble to keep her productions on a parity with those of other countries.' On the other hand, M. Philippe is enthusiastic in his praises of English marine chronometers, in which, he declares, English makers have so nearly attained perfection that it were useless for Swiss horologists to attempt to compete with them."

QUERIES AND ANSWERS.

J. T. M., B.—We have had the licensing question under consideration for some time, and we shall shortly open a discussion on the subject in our pages with a view of sounding the trade as to the best mode of obtaining the much-needed reform. Can you oblige us with a report of the cases mentioned from a local paper?

D. G., H. will find the required information in the present and next issue under "Trade Recipes, etc." We are quite willing to assist you, and the column devoted to "Queries" is at your service.

A. B. C. is subject to the same regulations as a regular dealer. As the case is, however, exceptional, and does not warrant the expense, and our correspondent is anxious in these hard times to earn a penny outside his usual branch, he may get over the difficulty by remaining the agent only. He can make arrangements with the party that provides him.

THE MEDAL OF THE TURNERS' COMPANY.

THE Council of the Horological Institute offer the Silver Medal of the Turners' Company, placed at their disposal by the Master and Court of the Worshipful Company of Turners, for competition, under the following conditions:—

The medal will be given to the producer of the best going barrel and stop work complete, executed by a resident in Great Britain.

Originality of construction, efficiency, and cheapness of production will be considered in making the award. Specimens for competition must be left at the house of the British Horological Institute, No. 34, Northampton Square, not later than Saturday, 5th April, 1879. The judges will reserve the right of withholding the medal in case no specimen of sufficient merit be sent in.

Messrs. H. M. Frodsham, Kullberg, and Walsh, have been requested to act as judges in making the award.

JEWELLERY.

By George Wallis.

(*Continued from page* 60.)

THE difference between the productions of Birmingham and London—for after all Clerkenwell is simply the jeweller's quarter of the metropolis, was much greater a few years ago than it is at present. In Birmingham mechanical appliances may be said from the beginning of the jewellery trade to have been essential to its success, and the various methods of stamping shapes out of thin plates of metal, as originally used in the production of steel work and buckle making, and subsequently as applied to button making (at one time the great staple of Birmingham), influenced in a large degree the methods adopted by the jewellers of that place, as distinguished from the pure handicraft system followed in London.

These mechanical methods have now been developed to an extraordinary extent, and are necessary to the success of the large concerns carried on at Birmingham; superseding as they do to a very large extent the hand labour of the past, which is reduced to minimum in the production of articles in extensive demand. The design or pattern being once settled the production of tho article by the gross is rather a question of machinery and metal than handicraft and skill. The accuracy of the parts as wrought out by machinery is such that practically the articles themselves may be said to be *flung* together by the hands of those who complete them. Even elegant designs for enamelled work, as well as imitations of engraved and engine-turned surface decorations, are now produced by "stamping" all the details at the same time and by the same blow which gives the contour to the metal.

It must be distinctly understood that in thus sketching the growth of the jewellery trade as an important industry, I do not include in any sense the manufactories of high class and court jewellery carried on to a very large extent at the west end of London, in which artistic workmen in gold are employed in the production of work of exceptional rather than general demand. Nor must it be forgotten that there is now a large and constantly increasing demand for artistic hand-made jewellery, which is supplied by many firms in Birmingham as well as in London, and that these articles are sent to the best markets in the world. Several of these firms employ designers on their own premises; and not only at the west end of London, but in Birmingham there are manufactories where every workman is engaged in producing an object of jewellery by hand craft, with the original design placed before him.

I have so far traced briefly, no doubt, but with a sufficiency of detail for all practical purposes, the origin and development of the manufacture of articles used for personal decoration in England. It is now desirable that the technical points necessary to an intelligent view of the nature of this industry should be considered.

The first step is to understand the nature of the material used. Of course modern trinkets, which may come to a certain extent under the generic name of jewellery, are manufactured of a great variety of materials besides gold, silver, and base metal covered with gold or silver. Of such are jet, glass in imitation of jet, tortoise-shell, bog-oak, coral, wood of varied tints, bone, ivory, and other substances. We must, however, confine our attention primarily to gold and silver ornaments, set with stones and otherwise embellished, and their imitations; treating of objects made in any other material incidentally, or as a means of illustration.

Gold in its pure state is never used in the manufacture of jewellery or plate. It is always alloyed with another metal or metals, and the quality is considered to be at once sufficiently pure, and yet well adapted to industrial purposes, when 18 parts of pure gold are combined with 6 parts of copper, copper and silver, or copper, zinc, and silver. French jewellery is traditionally of this standard. The English standards, as indicated by the numerals stamped on objects at the Assay Offices, are—22 carats, 18 carats, 15 carats, 12 carats, and 9 carats. The latter is used in the lowest kind of manufactured jewellery, but it is only by tradition that such a quality of metal can be called gold in any true sense. Still custom does not recognise it as a base metal, in the usual acceptance of that phrase.

The assay mark of much of the foreign jewellery is a very uncertain guide as to quality, because the manufacturer is permitted to secure the attendance of officials of the Assay Offices at the manufactory, which may easily be made to cover abuses of the assay mark.

As a contrast to the character of the 9-carat gold, the standard of the English sovereign, and in fact of most gold coins, may be quoted. This is 22 carat, or only two parts of alloy in twenty-four, which is really necessary to harden native gold, and make it stand the wear and tear of use as coin.

Formerly copper only was used as an alloy, and this will account for the red tint which is often seen in pure examples of old jewellery. The Dutch at one time had a special predilection for jewellery made of gold of this character. The modern use of zinc, in addition to silver, with the copper as an alloy, gives the manufacturer a great control over the tint of the metal, and enables him to adapt it to the special purposes to which it has been applied. By the use of these and other alloys, grey, yellow, red, and green tints are obtainable, which colours are sometimes introduced with great taste in relievo groups of foliage, flowers, etc.

Gold is usually purchased by the manufacturer from the refiner, and then alloyed according to his own wants and standard. Old coin is used to a considerable extent, and the Bank of England supplies it at the rate of £3 17s. 10½d. per ounce. As the character of the alloy of gold is well known, whether English or foreign, its purchase is a matter of considerable convenience to the manufacturer. The gold of old jewellery, injured by wear or out of fashion, is also rendered available to a large extent—and it is feared that many exquisitely wrought historical examples of the art workmanship of past periods have found their way to the refiner's crucible through the ignorance of the possessors, or the cupidity of dealers in old gold and silver objects. Happily the demand for objects in the museums has been the means of saving many an admirable example of old jewellery from the melting pot, through the fact becoming known that the bullion value was its lowest value, and that the workmanship increased that value in proportion to its excellence and the artistic character of the design. The fact too that some of the most exquisite examples of the jewellery of the sixteenth and seventeenth centuries were so designed and wrought, that the minimum of gold consistent with strength of contruction was used, prevented their being utilised as old gold, as comparatively little metal would have resulted from breaking them up. Thus the weight of metal, or at least extent of surface of metal, which will ensure destruction of a good deal of modern jewellery when out of fashion, has, by a reverse process, saved many an exquisite jewel of past ages.

(*To be continued.*)

SPECIAL NOTICE.

Several communications, including a report of a most pleasant and instructive visit to the factory and warehouse of Messrs. Thompson and Vine, watch and clock manufacturers and importers, of 118, Aldersgate Street, have to be held over for our next from want of space. Correspondents are requested to send in their communications as early as possible before date of publication.

TRADE RECIPES, &c.

(Continued from page 75.)

To Restore Watch Dials.—If the dial be painted, clean the figures off with spirit of wine, or anything else that will render the dial perfectly clean; then heat it to a bright red heat, and plunge it into a strong solution of cyanide of potassium; then wash in soap and water, and dry in box-dust. Repeat if not a good colour. Indian ink ground with gum-water will do for the figures.

To Make a Chronometer Oven.—Mr. W. E. A. Axon gives the following method for constructing a box suitable for testing watches with compensation balances, and for observing the effect of high temperatures upon aneroids:—Make an outer box, either of mahogany or oak, and line it with sheet-iron or block tin; let it have an aperture in front large enough to admit of lighting the gas-jets, which must be placed in the apparatus to obtain the required internal heat, the pipe for which should lie at the bottom of the box, bent in the form of a circle. At about four inches from the bottom a diaphragm of perforated sheet-iron should be fitted. It need not be made a fixture, but should be supported by brackets at the corners. The diaphragm will receive the principal heat from the jets, and tend to distribute it more equally. In the interior space a sheet-iron trough, with overlapping edges, should be placed so as to rest upon the rim of the outer box. Its dimensions should be such as to allow a space of two or three inches in clearance at the sides and bottom, between it, the outer box, and the diaphragm. Lastly, a light lattice-work cradle, made of wood, should be placed inside the inner iron box, for the purpose of holding the chronometers, watches, or aneroids to be tested. The lid to the whole apparatus should have a panel of plate-glass, through which the contents of the cradle will be always visible. The lid should fit closely at the edges, so as to retain the heated air in the cradle. Apertures must, of course, be provided at the upper portion of the outer box, to permit the products of combustion to escape. These apertures should be provided with sliding shutters or covers, to admit of them being entirely or partially opened so as to regulate the draught, and thereby the temperature of the interior. The dimensions of the various parts are not given, as the size of the box must depend upon the various requirements of different individuals.

To Preserve Sulphate of Iron.—Mix 4 parts of pure crystallized sulphate of iron, and an equal quantity of finely-powdered gum-arabic, with distilled water, and evaporate the solution in a water bath, at a low heat, till it has a sufficient consistency to be poured out on plates of glass. When it has been poured out in this way, and allowed to dry at a temperature of 30° Cent. in the dark, it may be cut up into lozenges, which can be kept for any length of time in a coloured stoppered bottle.

To Electro Gild without a Battery.—Take ½ oz. of nitric and ½ oz. of muriatic acid; dissolve in these 1 dwt. of gold, gently evaporate until it crystallizes, then add 2 oz. cyanide of potassium dissolved in 15 oz. of water. The article to be gilded is to be simply put in the solution, and a piece of clean zinc placed on it, and moved from one spot to another until it is sufficiently covered with gold.

Silvering Powder for Coating Copper.—Take 60 grains of nitrate of silver, 60 grains of common salt, 7 drams of cream of tartar. Mix them, moisten with water, and then apply.

Silvering Brass.—Brass and copper are the only metals that can be silvered without a battery. The process of silvering brass is conducted as follows:—In 8 oz. of water dissolve 2 oz. of cyanide of potassium, and in the same quantity of water 1 dr. of nitrate of silver. Into the vessel containing the silver throw about half a spoonful of common salt; stir this well with a glass rod until the silver is precipitated. Mix a little salt and water, and add a few drops to the solution after it has had time to settle. If any cloudiness follow, more salt must be added. When the addition of salt water has ceased to have any effect, carefully pour off the water and preserve the deposit. Wash this deposit two or three times in boiling water, and then carefully dry. Place this powder in a vessel, and pour on it about a pint of water, and add the cyanide solution about ½ oz. at a time until the precipitate is dissolved, then add enough water to make about a quart. While adding the cyanide solution, stir well. If when dipping the article into this solution the silver deposits too quickly, more water must be added; if it coats very slowly, the solution must be strengthened with more precipitate. This must also be done whenever the solution becomes weak. The solution when in use should be kept at a temperature of from 60° to 70° of heat. After polishing and burnishing, the article silvered should be as brilliant and durable as can be wished.

Gilding and Plating.—From an article of Professor Towler, an experienced instructor and successful experimentalist in electro-metallurgy, we extract the following practical instructions:—

The first thing required is a galvanic battery. There is a great variety of galvanic batteries to be had, but I prefer a Grove's battery. A single element consists of a cylinder of zinc, a thin plate of platinum, a tumbler, a cell of porous or unglazed earthenware, two binding-screws, two solutions (dilute sulphuric acid and concentrated nitric acid), two connecting wires, and a plate of silver and one of gold (a two-shilling piece for one, and a gold dollar for the other). Two of these elements will be sufficient for almost all ordinary operations of gilding, and sometimes only one is required. The zincs, plates of platinum, porous cells, binding-screws, tumblers, and connecting wires can be bought already prepared for electrolyte operations, and ready for mounting. Mix one fluid ounce of commercial sulphuric acid with ten fluid ounces of water for one solution. The strongest aquafortis or commercial nitric acid is suitable for the other solution.

In the second place, a silver and a gold solution have to be prepared and kept on hand ready for use. Each of these solutions is denominated an electrolyte, and the art of decomposing such a solution by means of an electric current is known by the name of electrolysis. To prepare the silver solution, take a solution of nitrate of silver, and add to it a solution of common salt as long as any white precipitate is produced. Perform this operation in a darkened room, because the white precipitate (chloride of silver) is very sensitive to light, thereby changing into a violet-coloured powder, which is insoluble in the fluid into which it is subsequently mixed. As soon as the precipitate has completely subsided, pour off the supernatant fluid, and add to it a few drops of the salt solution; if no milkiness is produced, the silver has all been removed as chloride, and consequently the fluid may be thrown away as useless. Mix the white chloride with rain water, stir the mixture with a glass rod, and allow the precipitate to settle again; this is called washing the precipitate. When the precipitate has subsided, the fluid part is poured off, and the residue is again washed. This operation is repeated several times, and the chloride, finally separated by decantation from the wash-water, is ready for the next treatment. Make a saturated solution of cyanide of potassium in rain-water—that is, add lumps of the cyanide as long as it is dissolved, and finally a small part is left undissolved. The water is then saturated with the salt. Pour this saturated solution of the cyanide upon the chloride of silver, and keep pouring and stirring until the chloride is entirely dissolved. Filter the solution, and dilute as follows:—Silver electrolyte; saturated solution of the chloride of silver in cyanide of potassium, 4 oz.; rain-water, 12 oz. The solution is then ready for use. Instructions for preparing of gold solution and mounting of battery will be given in our next.

(To be continued.)

HINTS TO REPAIRERS.

(*Continued from page 74.*)

THERE are numerous books written on the subject of calculating wheel teeth, but they are in general so complicated as to almost entirely exclude them from the understanding of the general repairer. This arises from the fact that their problems and solutions are generally carried out in algebra—a study that, unfortunately, very few repairers are conversant with. Such being the case, and believing a plain practical treatise on this subject desirable, we have endeavoured in the present article to give rules combining simplicity and precision, and have so arranged them that any one with a knowledge of the first four rules in arithmetic can understand and apply them.

Query.—How many revolutions will the last wheel or pinion in a train make for one turn of the first wheel, the number of wheel and pinion teeth being given?

Rule.—With the product of all the working pinion leaves multiplied together, divide the product of all the working wheel teeth multiplied together, and the quotient will be the number of turns and part of turns the last wheel or pinion will make for one of the first.

Problem.—Suppose the wheel teeth thus: 100, 80, 60, 50, and the pinions 20, 16, 10, 8. The operation would be—

$$\frac{100 \times 80 \times 60 \times 50}{20 \times 16 \times 10 \times 8} = \frac{24{,}000{,}000}{25{,}600} = 937\tfrac{1}{2},$$

this number being the turns of the last wheel in this train, for one of the first wheel. The desired result may also be obtained by dividing each wheel by its working pinion separately, and multiplying all the quotients together, thus:—

$$\tfrac{100}{20}=5; \quad \tfrac{80}{16}=5; \quad \tfrac{60}{10}=6; \quad \tfrac{50}{8}=6\tfrac{1}{4}; \quad 5 \times 5 \times 6 \times 6\tfrac{1}{4}=937\tfrac{1}{2}.$$

Problem second.—Given the number of beats in an hour, the number of wheel and pinion teeth; required the number of teeth to give the escape-wheel, so as to obtain the given number of beats an hour. (The balance makes two beats, in most escapements, for every tooth in the escape-wheel, therefore if the latter have twenty teeth, the balance would make forty vibrations for every revolution of the escape-wheel; if the escape-wheel have fifteen teeth, then thirty vibrations, etc.)

Rule.—Divide one-half of the number of given beats in an hour by the number of turns of the escape-wheel or pinion for one of the centre-wheel, and the quotient will be the proper number of teeth to give the escape-wheel.

Example.—Suppose the number of beats in an hour to be 16,800, and the number of wheel-teeth and pinion-leaves to stand thus: wheels, 80, 60, 56; pinions, 8, 8, 7; by the preceding rule we find the turns of the escape-wheel or pinion for one of the centre-wheel to be 600. The number of beats in an hour being 16,800, the half of this would be 8,400, and this divided by 600 will give 14—the proper number of teeth for the escape-wheel.

Problem third.—How many hours a watch or clock will run before being again wound up, the number of teeth in the barrel, and the number of turns it can make before the spring runs down, together with the number of the centre pinion teeth, being given?

Rule.—Divide the number of barrel teeth by the number of centre pinion teeth, multiply the quotient by the number of turns the barrel can make, and the product will be the number of hours the watch will go before being again wound up.

Example.—Suppose the barrel to have 96 teeth, the centre pinion 8 and the number of turns the barrel can make to be 3. 96 divided by 8 gives 12—the number of turns (or hours) the centre pinion makes for one of the barrel, which multiplied by 3, the number of turns the barrel can make, will give $12 \times 3 = 36$—the number of hours it will go without again winding. If it be desired to have the watch go 30 hours, and the number of turns of the barrel to be 3, the barrel would then have to make 1 turn in 10 hours, and consequently must have 10 times as many teeth as the centre pinion. If we choose to have 8 teeth for the centre pinion, the barrel must then have $10 \times 8 = 80$; if 6 teeth, then $6 \times 10 = 60$, etc., etc. When the watch or clock is desired to go a longer time, 8 days for instance, it is necessary to have an additional wheel and pinion, placed between the barrel and centre-wheel. We will suppose the barrel to have 96 teeth, the additional wheel to have 80, its pinion 12, and the centre-wheel pinion 10; it will be seen that the additional wheel makes but one turn in 8 hours, as $\frac{80}{10}=8$, and the barrel only one turn in $\frac{96}{12} \times 8 = 64$ hours, so that the watch or clock, with $3\frac{1}{2}$ turns of the barrel, will go 8 days. On the same principle it may be made to go a month or a year by adding one or more wheels.

Problem fourth.—What number of teeth to give the wheels in a train consisting of wheels and pinions, so that the last wheel or pinion numbers a given number of turns for one turn of the first wheel?

Rule.—The number of teeth in the pinions must first be chosen and fixed upon, these numbers multiplied together, and with this product multiply the number of turns the last wheel is to make; this will give such a number that, when divided by single factors, as 2, 3, 5, 7, etc., until the product (continuing each prime number until it no more equally divides) will give such prime numbers that can be multiplied together in sets to suit.

Example.—We will choose the number of pinions 12, 10, 8, and the number of turns the last wheel is to make (for one of the first) 200; these numbers multiplied together give $12 \times 10 \times 8 \times 200 = 192{,}000$; this divided by prime numbers gives $192{,}000 \div 2 = 96{,}000 \div 2 = 48{,}000 \div 2 = 24{,}000 \div 2 = 12{,}000 \div 2 = 6{,}000 \div 2 = 3{,}000 \div 2 = 1{,}500 \div 2 = 750 \div 2 = 375 \div 3 = 125 \div 5 = 25 \div 5 = 5 \div 5 = 1$; these factors are now multiplied together to suit in the following manner: $5 \times 5 \times 3 \times 2 = 150$, for the first wheel; $5 \times 2 \times 2 \times 2 = 40$, for the second: $2 \times 2 \times 2 \times 2 \times 2 = 32$, for the third wheel, as the following proof will show: $\frac{150}{12}=12\frac{1}{2}$, $\frac{40}{10}=4$, $\frac{32}{8}=4$, and these quotients multiplied together give $12\frac{1}{2} \times 4 \times 4 = 200$. If these numbers are thought not fitting on account of the size of the wheels, they can be arranged differently, thus: $5 \times 2 \times 2 \times 2 \times 2 = 80$; $5 \times 3 \times 2 \times 2 = 60$; $5 \times 2 \times 2 \times 2 = 40$.

Proof.—$\frac{80}{12}=6\frac{2}{3}$, $\frac{60}{10}=6$, $\frac{40}{8}=5$; these multiplied together give $6\frac{2}{3} \times 6 \times 5 = 200$, showing the numbers to be proper.

Problem fifth.—What number of teeth to give to the wheels in a train consisting of three wheels and pinions, when the balance is to make 16,800 vibrations an hour, or in the time the minute-hand makes one turn, and the escape-wheel has fourteen teeth.

Rule.—Divide the number of beats in an hour by double the number of escape-wheel teeth. This quotient will be the number of turns the escape-wheel will make in an hour; the numbers for the pinions are then chosen, multiplied together, and with the product multiply the former number of turns the escape-wheel makes in an hour; this product is then divided by prime numbers, and multiplied together into sets to suit.

Example.—16,800 being the number of beats given in an hour in the above problem, this, when divided by 28, double the number of escape-wheel teeth, gives 600—the number of turns the escape-wheel will make in an hour. The pinions are then chosen, which, in this case, will be 3 pinions of 8; these multiplied together, and then with the number of turns the escape-wheel makes in an hour, gives $8 \times 8 \times 8 \times 600 = 307{,}200$; this, divided by prime numbers, shows them to be 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 5, 5, which can be arranged into the following sets: $5 \times 2 \times 2 \times 2 \times 2 = 80$; $2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$; $5 \times 3 \times 2 \times 2 = 60$—numbers very good for practical use.

Problem sixth.—What number to give to the teeth of wheels in a watch where the seconds-hand makes one turn in a minute, or sixty turns in the time the balance makes a given number of beats in an hour?

Note.—The fourth, or seconds-wheel must always make sixty turns for one of the minute or centre-wheel.

Rule.—The train is divided by sixty, which will give the number of beats in a minute, and this quotient is then divided by double the number of escape-wheel teeth, which will give the number of turns the escape-wheel will make in a minute; from this quotient is derived the number of teeth for the seconds-wheel and the escape-wheel pinion. If the quotient is composed of a whole number, then the escape-wheel pinion may be any number chosen; the seconds-wheel must then have as many teeth as the product of the quotient multiplied by the number chosen for the escape-wheel pinion, but should the quotient be a number with a fraction attached, then the number must be altered into an improper fraction—the denominator of which will be the number for the pinion, and the numerator the number for the seconds-wheel. If the improper fraction be thought too high, it may be reduced.

Example.—Suppose the number of beats in an hour to be 18,000, and the escape-wheel to have 15 teeth; 18,000 divided by 60 gives 300 beats a minute; this quotient being divided by 30, double the number of escape-wheel teeth, gives 10; this being a whole number, the escape-wheel pinion may be of any number. If we choose 8 for the pinion, the seconds-wheel must have 8 × 10 = 80; if 6, then 6 × 10 = 60.

Example.—The beats an hour 18,000, the escape-wheel 14, what must be the number of teeth for the seconds-wheel and escape-wheel pinion? $\frac{18000}{60} = 300$; this divided by 28, double the number of escape-wheel teeth, gives $\frac{300}{28} = 10\ \frac{20}{28}$, or $10\frac{5}{7}$; this altered into an improper fraction, gives $\frac{75}{7}$, being 7 for the escape-wheel pinion, and 75 for the seconds-wheel. The preceding rules and examples are so arranged that the first three rules may be applied to any clock machinery; the last three being designed especially for watchmakers.

(*To be continued.*)

CORRESPONDENCE.

It must be distinctly understood that we do not necessarily identify ourselves with the opinions or views of any of our Correspondents. Our pages are alike open to all for free discussion of questions connected with the various trades which we represent, and all Correspondents will find every opportunity afforded them for expressing their opinions.

COMPULSORY HALL-MARKING.

To the Editor of the Watchmaker, Jeweller, & Silversmith.

Sir,—The letter of Messrs. Robbins and Appleton, in your last issue, is so far satisfactory that it has removed an impression that the firm would advocate a system of compulsory hall-marking in America, or desire to see such a system maintained in this country.

But it is equally certain that Mr. Bedford's evidence before the Select Committee conveyed that impression; that it was so understood by Mr. Prideaux is to be seen from that gentleman's evidence; indeed, it may be said that no other construction is possible when Mr. Bedford's evidence is referred to. Question 1709 is as follows:—

"Your idea is that the distinction of having the hall-mark is so advantageous that you wish it established in your own country?" Answer: "We would like to have an American hall-mark for the protection of the maker."

Then turning to Mr. Prideaux's evidence, question 1768, we find the following:—

"One word upon the evidence given by Mr. Alfred Bedford, the gentleman from America; that gentleman gave it as his candid opinion, did he not, that the hall-marking system was a good one?" Answer: "He did; I think I heard him say they would desire to have it in America."

Then follow questions and answers 1769 to 1772, which more clearly prove that Mr. Prideaux is under an impression that the system of compulsory hall-marking would find favour in America, such inference being quite as much in the case of silver-ware as in that of watches. What opportunities Mr. Prideaux may have had of forming an opinion relating to the views of Americans upon the hall-marking question, it is impossible to say, but I can scarcely believe that his opportunities have been greater than my own, seeing that there is scarcely a manufactory of any importance which I have not personally visited, nor a manufacturer of any note with whom I am not acquainted.

And what is my experience? Simply this, that the system of compulsory hall-marking is ridiculed throughout the United States. Furthermore, nothing can be more certain than this, that there is about as much chance of Americans adopting a system of compulsory hall-marking as of their having a king! It is rendered impossible by their system of State Government. If they passed such a law in Massachusetts, there would be no reason why such a law should prevail in Pennsylvania; if in New York, it would be wanting in Illinois,—and unless each state barricaded itself with protective duties, and surrounded itself with custom-houses, stopping each train as it passed from one state into another, it is difficult to see how any such law could be maintained. What would result here if we had compulsory hall-marking in Kent and free trade in Middlesex, or *vice versâ*? The fact is that the matter is absurd, regarded from any point of view.

I can well understand that so long as we in this country are so foolish as to barricade ourselves behind such foolish legislation, Messrs. Robbins and Appleton, will desire to avail themselves of it, so as to be on a level with English manufacturers. Their true interests, however, are freedom.

Yours, &c.,

Pall Mall East, London. Edward J. Watherston.
December, 1878.

CLOCK AND WATCHMAKERS' ASYLUM.

To the Editor of the Watchmaker, Jeweller, & Silversmith.

Sir,—Allow me to bring before your notice the claims of the Clock and Watchmakers' Asylum, as I feel sure at this charitable season you will not refuse an appeal through your valuable pages to your readers, who must be interested in all that concerns their trade.

As you are aware, this Asylum, instituted 1853, provides habitations, light, fuel, and pensions for aged and infirm members of the trade and their widows. Nineteen out of the thirty-two houses proposed to be built, are erected and occupied on the Asylum's own grounds at New Southgate.

We have received two donations of £500 from the Worshipful Company of Goldsmiths, besides an increased grant, annually, of one hundred guineas. The Worshipful Company of Clock and Watchmakers have also increased their annual subscription. I therefore appeal with confidence to your readers.

Each subscriber has a voice at general meetings of ordinary business, also a vote at elections of pensioners; whilst gifts of three guineas secure one, and five guineas two votes for life.

I am, sir, yours faithfully,
(Signed) G. Moore, Treasurer.

21, St. John's Square, Clerkenwell.
December, 1878.

THE ELECTRIC STOP-MOTION.

By W. H. Bailey.

A Paper read before the Scientific and Mechanical Society.

(*Concluded from page* 67.)

DESCRIPTION OF DIAGRAMS.

Drawing Frame, Fig. 2.—The action of the stopping-motions of this machine will be readily understood from the above sketch. V and T are rods or wires to convey electricity to the frame, from the magneto-electric machine. A C D and E are all connected with T, and H K L and N with V, so that when the cotton (M) is absent from between the rollers A H and L D, or when the cotton "laps" on the roller K, and raises the end until it touches C, and also when the can (Z) is full of cotton, and lifts the tube wheel (N) until it touches E, metallic connection takes place, causing the electric circuit to be completed, and so giving power to the magnet (P) to attract the lever (X), stopping the revolving of S, and so stops the machine by means of the knocking-off motion.

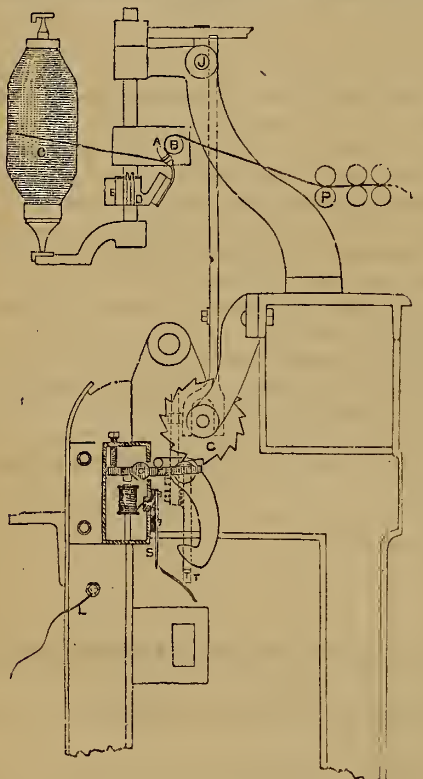

Fig 3a.

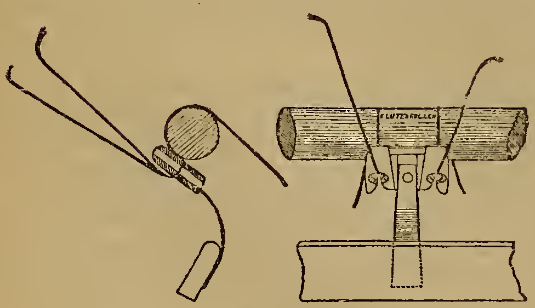

Fig. 4.

Intermediate Frame, Fig. 3.—The rod on which the springs (A) are fixed is in connection say with the positive pole of the battery, or magneto-electric machine. The fluted roller (B) is in connection with the opposite or negative pole of the battery or magneto-electric machine. When through breakage or absence of cotton the spring and the roller touch, electricity passes from the positive to the negative instantaneously. The rush of electricity is from the battery or machine—through the wires—through the magnet to A and B, where it is arrested by the non-conducting cotton keeping the metallic contact broken, and leaving a space across which the two electricities cannot leap and unite. But no sooner is this cotton absent than the metallic contact is formed, the rush of electricity takes place, the magnet E is charged and endowed with strength to attract one end of the double lever F. The other end rises and takes into a clutch, which in the ordinary way brings the knocking-off mechanism into action, and the machine is stopped.

Intermediate Frame, Fig. 3a.—Here the working position of the parts is shown clearly. a trying to press against B, but can't so long as the thread from C is between. Nor can the magnet (E) attract the finger (F), and therefore the catch wheel (G) passes clear of the longer end of the finger F. But the moment the thread, through being broken, or through the bobbin (C) becoming empty, allows A and B to touch, all is changed. The electricity rushes from the machine on its way to the point of contact between A and B, the magnet (E) being in the circuit—that is, the electricity on its way having to go through the magnet, the latter becomes charged, attracts one end of F, sends the other end upwards, which is caught by the revolving wheel (G), and the machine is stopped.

Fig. 4.—This figure shows the fluted roller, which is driven by gearing. Upon it presses the flat spring, but between the spring and the roller the two threads of cotton intervene, which are to be twisted together to form one thread, so, owing to the presence of these threads, the roller and the spring are kept apart. But when one thread breaks, the spring immediately forms contact with the roller, and as the spring and roller are connected to opposite poles of the battery or magneto-electric machine—their contact completes the circuit—allows the electricity to pass, and as the magnet is in the current, it becomes charged and endowed with power to attract a small light finger, which, by operating a clutch in the ordinary way, stops the machine.

THE DIAMOND MERCHANTS' CLUB.

The first annual dinner of the above-named club was given at their rooms, 146, Holborn Bars, on the 17th ult. About fifty of the members, besides several influential visitors, sat down to a sumptuous repast excellently served. After the cloth had been removed, and the usual loyal toasts given, Mr. Albert, in very eloquent language, proposed the toast of "Success to the Diamond Merchants' Club." He alluded to the many previous attempts which had been made to establish such a club, and how each endeavour had failed, and attributed the great success which has attended the present undertaking to the earnestness, unremitting zeal, and energy displayed by the President and Vice-President, and to whose endeavours the result now witnessed must be attributed. He explained that from a small commencement, only one year since, the club had not only increased to over 100 members, but likewise accumulated property to the value of nearly £2,000, all of which had been paid for. He hoped the present officers would continue to put forth their utmost exertions to maintain the prosperity of the club, and particularly alluded to the heavy duties which had devolved on the Vice-President during the protracted absence of the President, and how greatly the club was indebted to him for the trouble, time, and energy which he had devoted to secure its prosperity.

The healths of the President, Vice-President, Treasurer, Hon. Sec., visitors, and others were given and duly responded to, and the company separated towards early hours of the morning, having spent a most enjoyable evening.

The music was provided by Professor Jona Greebe, on whom it reflected great credit.

The officers for the ensuing year are—Messrs. A. Auerhahn, President; S. Goldman, Vice-President; E. Gomperts, Treasurer; M. Davis, Hon. Sec. J. Baum, N. Tannenbaum, — Sessel, — Van Straalen, F. Cook, F. Nyborg, S. Gomperts, — Ricardo, and H. Samuel, Committee.

Plaster of Paris mixed with equal parts of powdered pumice-stone makes a fine mould for casting fusible metals; the same mixture is useful for incasing articles to be soldered or brazed. Casts of plaster of Paris may be made to imitate fine bronzes by giving them two or three coats of shellac varnish, and when dry applying a coat of mastic varnish, and dusting in fine bronze powder when the mastic varnish becomes sticky.

BRONZES.

By C. D. E. Fortnum, F.S.A.

Continued from page 65.

ANALYSES has proved it to be composed of—

Copper	90·68 to 91·40
Tin	1·70 ,, 2·32
Zinc	4·93 ,, 5·53
Lead	1.07 ,, 1·37

The bronze statue of Lous XV. is composed of an alloy of less value. viz :—

Copper	82·45
Zinc	10·30
Tin	4·10
Lead	3·15

Sir Humphry Davy recommended for large works 10 parts of copper to 1 of tin. The composition of gun metal has varied from the time when it was so much encouraged by Queen Elizabeth. In olden times the typical proportions were 100 copper to 12 tin. In 1614, according to Diego Ufano, the following proportions were variously used by different gun founders.

Copper	160	100	100	100
Tin	10	20	8	8
Brass	8	5	5	0

Our later mixture is of 90 copper and 10 tin.

Bell metal also varies, the introduction of silver and other metals having been supposed to produce effects upon the sound. Perhaps the portions of—

78 parts of copper, or 80
and 22 ,, ,, tin, or 20

may be considered as nearly typical. Theophilus tells us that to the copper one-fifth part of tin is added to make bell metal, the details for the casting of which he also gives.

For medals a good alloy is formed by the fusion of

Copper	88
Tin	10
Zinc	2

Another mixture is of—

Copper	90 or 92
Tin	8 or 10

lead in small quantities being sometimes added to increase the fluidity. We are not aware of any traces of zinc having been discovered in the bronze tools and weapons of Egypt or of Greece, neither has it been found in any appreciable quantity in European implements of the bronze period. There can be little doubt that zinc was indirectly known to the Romans, although their acquaintance with it in a simple metallic state must have been very limited. Strabo and Aristotle speak of an earth, and Pliny tells us that certain mines produced ores, which on smelting, yielded a golden-coloured metal highly esteemed, and that it was much regretted when lost by the exhaustion of the lodes. These ores were probably the copper-pyrites, with which a considerable quantity of "blende," the sulphuret of zinc, occurred, as is frequently the case in our Cornish and other mines; or the mineral may have contained some considerable portion of the earth known to the ancients as *cadmia*, in all probability the calamine of mineralogists, (native carbonate of zinc), which, when added to copper in a state of fusion, gave it a yellow colour, producing the rich-looking metal known as *aurichalcum.*

The bishops, Ambrosius of Milan (A.D. 374-379), Promasius of Adrumetum (sixth century), and Isidore of Seville, (about 570-636), refer in their writings to a substance, the addition of which to copper gave it a yellow colour; and we find that many of the objects for church use, in the Rhenish, Byzantine, and subsequent periods of art, are formed of a bronze of yellow colour, which probably contains a considerable mixture of zinc. We have already referred to the *aes* and *aurichalcum* of the monk Theophilus; varieties, in fact, of brass produced with the calamine by a nearly similar process to that referred to by the ancient classic writers. Paracelsus, the Swiss physician (1493-1541), speaks of the metal *zinc.* It is the *contrefeyn* of the Saxon metallurgist Agricola (1494-1555), and Robert Boyle, the philosopher, refers to it as *speltrum.* In 1721, Heuckel procured zinc in the metallic state from calamine. Van Swab, in 1742, reduced it from Swedish ores, and in 1746 Marsgraf published a method for its reduction. The first works in England seem to have been those of Champion, near Bristol, about 1760, where the metal was reduced from its ores and sent into Birmingham under the name of zinc, or spelter.

The more important minerals of zinc are the sulphuret, known as zinc blende, and "black jack," and the native carbonate, calamine; both of these minerals are more or less widely distributed. The former is reduced by first roasting it in contact with the air, to burn off the sulphur, and then fusing in contact with carboniferous substances, as charcoal, etc. The metal, which burns and volatilizes at a comparatively low temperature, is conveyed in the form of vapour from the closed crucible by a descending iron tube into water, at the bottom of which it is deposited in cakes—the spelter of commerce.

Brass, a mixture now so important in manufactures, has been more or less known thoroughout Europe, in slightly different varieties, under the names of *electrum* and *latone*, used by the early writers as synonymous with *orichalcum* and *aurichalcum, laiton* (Fr.), *latten* (Ang.), pinchbeck, tombac, Corinthian metal, princes' metal, or-molu, mosaic gold, similor, glanzgold, etc. The white copper of china, speculum metal, and the white alloys known as nickel and German silver, albata, and Britannia metal, etc., are varying mixtures of copper with tin, nickel, zinc, lead, etc. The relative proportions to make the hard yellow brass may be stated generally at 70 of copper to 30 of zinc; for red brass, 80 copper to 20 of zinc; and for brass wire, which must be tenacious and somewhat ductile, 70 copper, 30 zinc, and some lead.

Mines of "latten" are referred to in the time of Henry VI., but the manufacture seems to have taken a definite form in England, under the encouragement of Queen Elizabeth, who, in 1563, granted certain rights, by patent, over the *calamine* found in this country, and in Ireland, to William Humphrey, her assay master, who was in partnership with one Christopher Shutz. This man was experienced, not only in the finding of that material, but in its use for the production of the mixed metal called *latten*, or *brass.* A corporation was afterwards formed, and joined by some of the leading nobility, under the name of the "Society for the Mineral and Battery Works," 1568. In 1650, one Demetrius, a German, had a large work in Surrey, and others existed near London, and in Nottingham; but the trade declined in 1670, and did not recover till early in the next century, when, in 1708, an act was passed, in answer to a petition made by the brass-workers for encouragement, repealing certain export duties in copper and in brass-wire. It greatly revived about 1720, aided by and encouraging the development of copper-mining operations in Cornwall. About 1740, the Turner family introduced the manufacture into Birmingham, which has since become the capital of this extensive branch of industry.

(*To be continued.*)

ERRATUM.

IN our last issue, in noticing the Mayoral Collar and Badge manufactured by Messrs. J. R. Williams and Son, of Hatton Garden, for the Mayor of Lancaster, we mentioned that the same firm had made a chain for the Mayor of Liverpool at a cost of £1,500; instead of "chain" we should have said "collar and badge."

ROUGE:

Its Manufacture and Application.

(By H. Bush, Working Jeweller, Hull.)

THE rouge which is used by gold and silversmiths, watch-case makers, and art metal-makers, to give the finishing polish to their manufactures, is produced by various methods and of different qualities.

The ordinary rouge of commerce is obtained on a large scale as a secondary product in the manufacture of concentrated sulphuric acid, where it forms the residue of the distilled sulphate of iron; it is, however, generally impregnated with nitric acid, and is boiled in a solution of potash to neutralize the injurious effects resulting from its presence. This rouge does not always possess the property required for its use, being often gritty and liable to produce scratches on a polished surface. In order to avoid this, it must be carefully washed and levigated in a glazed earthen vessel, containing sufficient clear water to allow the coarser particles to sink to the bottom, the liquid poured off into another vessel, and the deposit thrown away. The rouge in solution is then covered with a cloth and allowed to settle for twenty-four hours, the water poured off, and the rouge dried in the air. To render it still more perfect it is again washed and cleared to remove any coarse substances which might have remained; and then dried again, diluted with spirits of wine, placed on the fire and allowed to burn; this last operation removes any grease present.

A good rouge is made by reducing to fragments sulphate of iron (green copperas), which are placed in a crucible and subjected to a furnace-heat capable of melting gold or silver. The crucible is then removed from the fire and left to cool; the copperas will be found to have changed its colour to a deep yellow. The mass is powdered and sifted through a tin plate with fine holes, again placed in a crucible, covered and left in the fire until vapour has ceased to come from it. It is then removed, left to cool, and the result will be a fine loose powder of a light red colour, which should be boiled in water and washed and levigated as above described.

Another good rouge is obtained from 16 parts of sulphate of iron (calcined), 16 parts of well-dried potash, and 1 part of saltpetre. These ingredients are exposed to a good furnace-heat in a covered crucible for about an hour and then left to cool.

The mass is finely powdered, washed, and levigated, and a rouge of a coffee colour will be obtained. It may be used in this state, yet if again exposed to a good furnace-heat for a short time, it will assume the much-liked violet colour, and will be of superior quality.

Another excellent rouge is made by dissolving 1 part of oxalic acid, and 2 parts of clear sulphate of iron, in 6 and 8 parts respectively of boiling rain or distilled water each solution is filtered through fine linen, boiled separately, and whilst boiling, poured together. The result will be a yellow precipitate, which, when dry, is placed over the fire or a spirit lamp in a metal pan, and stirred for several minutes, when it will assume a cinnamon colour.

Rouge is made in a variety of colours, from light red to dark violet, owing to the various degrees of heat applied; the greater the heat the darker the colour. The light colour, generally called "gold rouge," is best adapted for gold and silver, whilst the dark coloured "steel rouge" is best suited for the latter metal.

Rouge should always be used in a moist state, and the best polish will be obtained by using two qualities, beginning with a coarser kind, and finishing with the finest. The different qualities may be produced as follows: Stand three glass or china vessels in a dust free place, fill one of these with clean water, and put a quantity of powdered rouge into it, keep stirring with a piece of wood until the powder is perfectly dissolved, and then allow to settle for about half a minute. Pour the liquid into the second vessel, leaving the deposit behind; allow the solution to settle again for about a minute, after which pour it into the third vessel, leaving the deposit. The liquid in the third vessel is then left to settle thoroughly and afterwards carefully separated from the deposit. This last deposit will naturally be the finest; the one in the first vessel containing all the impurities, may be thrown away. The deposits must be well dried and kept in closed boxes, and moistened with spirits of wine before using.

By following the above instructions a rouge will be obtained securing the highest finish.

SELF-ILLUMINATING WATCH FACES AND CLOCK DIALS.

MONS. OLIVIER MATHEY, a Neufchâtel chemist, and the manufacturer of the well-known "Diamantine," communicates the following information in regard to the composition of these dials, to one of our foreign exchanges:

Phosphorescent dials are usually made of paper, or thin cardboard, enamelled like visiting cards. They are covered with an adhesive varnish, or with white wax, mixed with a little turpentine, upon which is dusted, with a fine sieve, powdered sulphide of barium—a salt which retains its phosphorescence for some little time. The sulphides of strontium and calcium possess the same property, but lose it more quickly than the former. After the dial has remained in darkness some days it loses its phosphorescence; but this may be readily restored by exposure for an hour to sunlight; or, better still, by burning near the dial a few inches of magnesium wire, which gives forth numerous chemical rays.

Mons. Recordon, of Paris, states that two years ago he took out a patent for, and has since been manufacturing, illuminated dials, on an entirely different principle from those produced by the use of chemicals. His device is this: A Geissler tube, containing a gas which gives a brilliant light, is placed on the dial; a battery about the size of a thimble is attached as an ornament to the watch-chain, and a miniature induction coil is also hidden in the latter. When it becomes desirable to consult the watch in the dark, a spring is pressed, the current passes into the coil, then into the Geissler tube, and illuminates the dial. The portable battery used for this purpose is that of Trouvé, which, in a small compass, has considerable strength. Reduced to the size of a thimble, it is still sufficiently strong in its action to last a year. Mons. Recordon also applies the same principle to the illumination of clock faces.

NEW REGULATING ATTACHMENT FOR CLOCK PENDULUMS.

OUR valuable American contemporary, the *Scientific American*, describes a novel and ingenious device for regulating clock-pendulums, recently patented in the United States.

An arbor passes through the centre of the pendulum-ball, and is squared at each end to receive at the front an index, and at the back a cam, which engages a lug in the extreme lower end of the pendulum-rod. The index moves over a small dial, which is graduated, so that each number correspondents to one minute per day, so that by turning the index in one direction, the pendulum-ball is lowered, and the movement of the clock retarded; by turning it in the opposite direction, the ball is raised and the movement accelerated. The key that is used for winding the clock is adapted to the regulator. This regulator is not only useful, making the adjustment of the pendulum simple and positive, but it also adds greatly to the appearance of the clock, being itself an ornamental object.

THE PLACE OF JEWELLERY IN ART.

A Paper read at the Social Science Congress, Cheltenham.

By Edward J. Watherston,
Member of the Society of Arts.

(*Continued from page* 81.)

NEXT to the decorations for the head those destined for the neck and bosom played the most notable part in Greek and Roman personal ornaments. It is most surprising that some of the designs of necklaces, adopted, in particular, by the women of Greece, have not found grace in the eyes of modern ladies, unquestionably beautiful as they are, and befitting moreover to varieties of costume, by alterations in form and colour most suitable to the wearer. Perhaps there is nothing more charming to be found among these ancient necklaces than the three stringed ones of pearls, intermixed with precious stones. Usually, the upper string—loosely hung, if it were wished to make the neck appear more slim than naturally, and tight if the contrary was desired—was made of pearls; while the second, hanging some way down the bosom, was composed alternately of pearls and precious stones; and the third, falling in its lower part upon the centre of the bosom, was entirely of precious stones, carefully selected, in shape and colour, to suit the wearer. The arrangement of these three strings of pearls and precious stones around the necks and bosoms of the Grecian ladies was artistic to the highest degree. It is possible, as is indeed generally believed, that in the design and disposition of these and other personal adornments the ancient Greeks were governed solely by an instinctive sense of beauty; but it must be admitted that there is no great improbability of their having acted in obedience to some distinct and well-defined rules of art. That there was a geometrical law of beauty was asserted already by the philosopher Pythagoras, five hundred years before the Christian era; and the doctrine was upheld in modern times, by Dr. Peter Camper, a learned German, by Sir Charles Bell, Mr. D. R. Hay, of Edinburgh, and others. Mr. Hay reasons, or states his argument, that "the scientific principles of beauty appear to have been well-known to the ancient Greeks, and it must have been by the practical application of that knowledge to the arts of design that that people continued for a period of upwards of three hundred years to execute, in every department of these arts, works surpassing in chaste beauty any that had ever before appeared, and which have not been equalled during the two thousand years which have since elapsed." As regards the human body, the same author maintains that even its beauty can be shown to depend on the geometrical regularity of certain angles, "all of which are simple submultiples of some given fundamental angle, or bear to it a proportion expressible under the most simple relations, such as those which constitute the scale of music"; and further, that "the contour of a well-formed body is resolved into a series of ellipses of the same simple angles." Whatever there may be of truth in this proposition, it is curious that in the contours, drawn after this precept, there are several that take the precise outline of articles of ancient Greek jewellery. This is the case more particularly with the just-mentioned triple necklace of the Greek ladies, marked by a round line under the head, an oval one falling on the bosom, and a still more pending curved line sinking lower down. However, whether the art of thus designing personal ornaments after strict geometrical rules of beauty was really known to the Greeks, or not; we certainly have lost it. Scarcely, perhaps, would we even give much for its re-discovery, accepting, as most of us do, the maxim of Longfellow, laid down in his "Psalm of Life," that "Art is long and time is fleeting."

In conformity with all their views of adorning the human figure, so as to attain to the utmost perfection of beauty in appearance, the Greeks paid comparatively little attention to such minor ornaments as bracelets and finger rings. The diadem on the head, and the necklace, uniting symbolically the head with the bust, gracefully covering the latter part, were clearly ornaments made to beautify the whole body; but this was not so as regards all the embellishments attached to arms and fingers, which could only serve to enhance these special parts of the human frame. This was, undoubtedly, a true principle of art, which we, with many others, have entirely forgotten. There are many specimens of beautiful bracelets, of evident Greek manufacture, still in existence; but it is very doubtful whether they were ever largely used as personal ornaments. The Bacchæ, Menades, Thyades, and other persons taking part in the festivals of the god Bacchus, and generally called Bacchantes, were the first to wear bracelets, and their use as an ornament extended from them to women of the lower and middle classes. The very small value set upon bracelets, as ornaments, is shown in that in the earliest times they were made of no better material than thin plates of bronze, of more or less plain shape, or else wires twisted like a cord. Homer alludes to them, in the "Iliad," when speaking of "twisted spirals." While never in high repute among the Greeks, the "armilla" sank lower still among the Romans, when men began to adopt the arm-ring, and women left off wearing it, till gradually it became a badge of merit for deeds of military prowess, losing entirely the character of an ornament.

Finger rings, so important a part in modern jewellery, were originally even less esteemed, and naturally so, as ornaments for the human body, than bracelets. At the outset, they were indeed mere implements, used as seals, or keys, and for various other purposes. The Greek, as well as the Roman matron, wore a large engraved ring, mainly for the purpose of closing store cupboards, wine cellars, jewellery boxes, and similar receptacles, and to protect the contents against the servants and strangers, by the simple process of impressing a seal in wax, or sometimes a kind of soft earth. Similarly, the men had an "annulus signatorius" for sealing letters and documents. For a long time, and up to the highest period of Greek art, ladies only wore one ring, on the fourth finger of the right hand, not as an ornament however, but entirely in their vocation as household managers. It was only when a decline of taste and of public morals set in, that both women and young men together commenced wearing a number of finger rings. The fashion met with severe censure from critics; and when growing into absurdity, by the increase of rings, which were made to cover the fingers of both hands from top to bottom, the great Aristophanes darted, again and again, the shafts of his satire against it in his comedies. He invented a ludicrous title for the ring-wearers, calling them "Sphragidonychargokometes," the word, long to absurdity, signifying a "person-who-has-the-fingers-covered-up-to-the-nails-with-rings." The title caused laughter enough, and the ring-wearing custom diminished greatly through the influence of satire. Under the Romans, the ring gradually became a badge of honour, like the bracelet, and also a pledge of intended marriage, in the form of the "annulus pronubus." As such its significance has come down to our days. Still even in comparatively modern times critics have been as severe upon rings, considered as ornaments, as formerly Aristophanes. Thus Hall, in his "Satires," published in 1598, exclaims:

> "Nor can good Myson wear on his left hand
> A signet-ring of Bristol diamond,
> But he must cut his glove to show his pride,
> That his trim jewel might be better spied."

(*To be continued.*)

Prices Current for Gold and Silver.—Value Given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver 4s. 6½d. to 4s. 9d. (variable according to quantity).

THE

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PATENTS.

Applications for Letters Patent.

5038. WILLIAM WEST, of Birmingham, in the county of Warwick, Manufacturing Jeweller, for an invention of "Improvements in brooches and other dress fastenings or dress ornaments."—Dated 9th December, 1878.

5072. FRANCIS JOSEPH PERKINS, of Frome, in the county of Somerset, Watchmaker, for an invention of "Improvements in regulators for watches, portable clocks, and other timepieces."—Dated 11th December, 1878.

5073. JACOB OTTO SCHULER, of Hatton Garden, in the county of Middlesex, Merchant, for an invention of "Improvements in bracelets, necklets, and rings."—A communication to him from abroad by Ernst Schonfeld, junior, of Hanau, in the German empire.—Dated 11th December, 1878.

5108. GERARD WENZESLAUS VON NAWROCKI, of the firm of J. Brandt and G. W. von Nawrocki, Patent Agents, of 124, Leipzigerstrasse, Berlin, in the empire of Germany, for an invention of "Improvements in studs or fasteners."—A communication from Eduard Weiler, of Berlin, in the empire of Germany.—Dated 13th December, 1878.

5127. FRIEDRICH CARL GLASER, of 92, Lindenstrasse, Berlin, in the kingdom of Prussia and empire of Germany, Engineer and Patent Agent, for an invention of "A new and improved process of plating metals, and more particularly iron, steel, copper, and the alloys of the latter, with nickel or cobalt."—A communication from Theodor Fleitmann, a person resident at Iserlohn, Prussia, German empire.—Dated 14th December, 1878.

5136. BENJAMIN JOSEPH BARNARD MILLS, of the firm of Harris and Mills, of 23, Southampton Buildings, in the county of Middlesex, Patent Agent, for an invention of "Improvements in or additions to chronometrical apparatus, especially watches for the pocket, whereby the same are rendered capable of transmitting electrical signals."—A communication to him from abroad by Ernest Ganelli and Felix Bardelli, both residing at Turin, in the kingdom of Italy.—Dated 14th December, 1878.

5166. THOMAS JAMES SMITH, of the firm of Robertson, Brooman, and Company, of 166, Fleet Street, in the city of London, Patent Agents, for an invention of "An improved illuminable dial-plate applicable to night-clocks, marine compasses, and other similar objects."—A communication to him from abroad by Charles Desprez, Watch and Clockmaker, at present residing at 23, Boulevard de Strasbourg, Paris, France.—Dated 16th December, 1878.

Patents Sealed.

2478. THOMAS JOHNSON POTTER, of Clapham, in the county of Surrey, Master of Arts, for an invention of "Improvements in the construction of telescopes."—Dated 21st June, 1878.

4007. RAPHAEL HUNTER BRANDON, Engineer and Patent Agent, of 38, Southampton Buildings, London, and 1, Rue Laffitte, Paris, for an invention of "Improvements in the mechanism and the working of electric clocks."—A communication to him from Charles William Firnhaber, a person resident in Paris, Rue Laffitte, 1.—Dated 10th October, 1878.

Notices to Proceed.

3091. WILLIAM ROBERT LAKE, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, has given notice in respect of the invention of "Improvements in watches and other time-keepers."—A communication to him from abroad by Victorien Bousset, of Morez-du-Jura, Jura, France.

3718. EDWARD THOMAS HUGHES, of the firm of Hughes and Son, Patent Agents, of 123, Chancery Lane, London, has given notice in respect of the invention of "Improvements in musical boxes."—A communication to him from abroad by Messrs. Henry Jacques Antoine Mertet and Louis Joseph Petite, of Geneva, Switzerland.

4921. WILLIAM ROBERT LAKE, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, has given notice in respect of the invention of "Improvements in and relating to the electro-deposition of nickel, and in articles manufactured of or plated with the same, which invention is partly applicable to the electro-deposition of other metals."—A communication to him from abroad by Edward Weston, of Newark, New Jersey, United States of America, Electrical Engineer.

Patents which have become Void.

4130. WILLIAM FORD STANLEY, of Great Turnstile, Holborn, in the county of Middlesex, for an invention of "Improved machines or clocks to register conditions of the atmosphere and to keep correct time."—Dated 29th Nov., 1875.

3266. HEINRICH WITZENMANN, Manufacturer of Jewellery at Pforzheim, Grand Duchy of Baden, for an invention of "Improvements in the manufacture of linked chains, and in means or apparatus employed therein."—Dated 2nd December, 1871.

4333. MARIUS ANTHONY PRADIER, of 7, Bedford Street, Bedford Square, in the county of Middlesex, Manufacturing Jeweller, for an invention of "A new and improved method of fastening and unfastening the shirt collar, or other stud, sleeve-link, and solitaire, by means of the screw principle."—Dated 14th December, 1875.

Grants of Provisional Protection for Six Months.

4536. JOSEPH TRANTER, of Birmingham, in the county of Warwick, Jeweller, for the invention of "Improvements in fastenings for bracelets, necklets, scarf rings, and lockets."

4833. LAURENTIUS ANDREAS WALDEMAR LUND, of Birmingham, in the county of Warwick, for the invention of "Improvements in studs and solitaires."

4674. AUGUSTE LION, Jeweller, of the city of Paris, in the Republic of France, for the invention of "Improvements in bracelets, necklets, and chains, and in their mode of manufacture."

5073. JACOB OTTO SCHULER, of Hatton Garden, in the county of Middlesex, Merchant, for the invention of "Improvements in bracelets, necklets, and rings."—A communication to him from abroad by Ernst Schonfeld, junior, of Hanau, in the German Empire.

5127. FRIEDRICH CARL GLASER, of 92, Lindenstrasse, Berlin, in the kingdom of Prussia and empire of Germany, Engineer and Patent Agent, for the invention of "A new and improved process of plating metals, and more particularly iron, steel, copper, and the alloys of the latter, with nickel or cobalt."—A communication from Theodor Fleitmann, a person resident at Iserlohn, Prussia, German empire.

Patents on which the Stamp Duty of £50 has been Paid, and Dates of their Production for Certificate.

4403. RICHARD QUIN, of Poland Street, Oxford Street, in the county of Middlesex, trading under the style or firm of Moran and Quin, Jewellery Case Makers, for an invention of "Improved opening and closing arrangements applicable to cases for containing jewellery, plate, papers, pictures, and other articles."—Dated 18th December, 1875.

Patents Granted in Foreign States.

UNITED STATES OF AMERICA.

208,968. WELLINGTON P. DOLLOFF, of Providence, R.I., for "Earrings."—Application filed 31st July, 1878.

209,098. D. C. WOLF, of Keota, Iowa, assignor of one-half of his right to Jacob S. Kulp, for "Striking attachments for clocks."—Application filed 26th June, 1877.

209,340. WM. HAINES, of Philadelphia, Pa., for "Adjustable watch-keys."—Application filed 10th May, 1878.

209,361. J. HEINRICH SANDMEYER, of Chicago, Ill., for "Watchmakers' lathes."—Application filed 16th July, 1878.

209,375. C. O. BALLIETT, of Waterloo, Iowa, for "Reversible centre-pinions for watches."—Application filed 9th September, 1878.

209,453. CLARK B. BRYANT and AUGUSTUS D. HENDRICK, of New Haven, Conn., assignors to the New Haven Clock Company, of the same place, for "Calendar-clocks."—Application filed 5th October, 1878.

209,441. WILLIAM H. ZINN, of Boston, Mass., for "Watch-winding devices."—Application filed 8th April, 1878.

209,457. **A. Call**, of Santa Fé, N. Mex., for "Safety-clicks for watch-barrels."—Application filed 11th March, 1878.

209,458. **Andreas M. Carlsen**, of Brooklyn, N.Y., for "Calendar-clocks."—Application filed 3rd September, 1878.

FRANCE.

124,268. **Piaubert**, for "Striking-work for clocks."

124,279. **Hubert**, for "Applying the galvanoplastic process for the manufacture of clock-dials."

124,454. **Chateau**, for "A compound movable and spring wooden or cuckoo clock."

124,292. **Bayme**, for "Socles of clocks of moulded glass imitating marble."

124,301. **Ahrle** and **Lorenz**, for "Gilt foil on precious stones."

124,272. **Weil** and **Refoubelet**, for "Jointed bracelets for ladies and children."

124,318. **Massin**, for "Diamond lace, guipure, and embroidery."

124,319. **Massin**, for "Applying gold and silver filigree for mounting diamonds and precious stones."

124,478. **Deny**, for "A medallion."

119,606. **Marx**, for "Improvements in medallions and similar articles."

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Baker, Geo., Wells Street, Lozells, near Birmingham, late Branston Street, Birmingham, jeweller. Nov. 29. A. Pointon, sol., Temple Row, West, Birmingham.

Berrow, Edward James, High Street, Solihull, watchmaker. Nov. 28. W. Fallow, sol., Cherry Street, Birmingham.

Gardner, Wm., Exchange Buildings, and Johnson Street, Cheetham, both Manchester, jeweller. Nov. 30. Sale, Seddon, Hilton, and Lord, sols., 29, Booth Street, Manchester.

Humel, Sigmund, High Street, Swansea, jeweller. Nov. 27. C. H. Glascodine, sol., Swansea.

Lepp, Jas., Rock Street, Bury, watchmaker. Nov. 30. G. Whitehead Son, and Dodds, sols., Bury.

Luddy, Chas. Broughton, 193, Burrage Road, Plumstead, late electro-plate manufacturer. Nov. 25. J. D. Peard, sol., 25, Lincoln's Inn Fields.

Marcoso, Edward Marcus, 47, Bernard Street, Russell Square, diamond merchant. Nov. 28. G. and W. Webb, sols., 11, Austinfriars.

Scanlan, Robt., Orchard Street, Preston, watchmaker and jeweller. Dec. 3. J. Thompson, sol., Preston.

Mugridge, Chas. Edward, and **Chas. Henry Laubenberg**, Great Charles Street, Birmingham, importers of watches and musical boxes. Dec. 5. Southall, Thomas & Southall, sols., Waterloo Street, Birmingham.

Lezard Flavien Ernest, trading as **J. F. Lennard**, 133, Gower Street and Tottenham Court Road, jeweller. Dec. 2. A. Leslie, sol., 34, Conduit Street.

Cook, Alfred William, St. John's Gate, Clerkenwell, jeweller. Dec. 3. E. T. Tadman, sol., 4, Gray's Inn Place, Gray's Inn.

Joseph, Michael, High Street, Sunderland, jeweller. Nov. 28. C. B Hodgson and Haigh, sols., Waterloo Street, Birmingham.

Eley Hodson, Wide Bargate, Boston, watchmaker. Nov. 28. G. W. Thomas, sol., Boston.

Hawkes, Samuel Bennett, trading as Samuel Bennett, Camden Street, Birmingham, electro-plater, late St. George's Terrace, Brearley Street, Birmingham, jeweller. Dec. 10. Hornblower and Hadley, sols., Birmingham.

Jeffries, Robert, Lord Street, Southport, jeweller. Dec. 13. At Walton and Smith's, sols., Southport, Jan. 8 at 11.

White, Thos. and **Fredk. Campbell**, 133, New Bond Street, jewellers. Dec. 11. A. C. Lewis, sol., 7, Furnival's Inn.

White, Thomas, 133, New Bond Street, jeweller (sep. crdtrs.) Dec. 11. A. C. Lewis, sol., 7, Furnival's Inn.

Whittaker, Thomas, Manchester Street and Victoria Market, both Oldham, jeweller. Dec. 13. Ascroft and Sons, sols., Oldham.

Cooper, Stephen Oswald, 88, St. Oswald's Grove, Rochdale Road, Manchester, jeweller. Dec. 17. J. A. F. Eltoft, sol., 36, King Street, Manchester.

Klugman, Hyman, Newsome's Yard, Briggate, Leees, watch material dealer. Dec. 21. E. Lodge, sol., Park Row, Leeds.

Trustees Appointed.

Lecomber, John (Bkt.), Slater Street and Duke Street, both Liverpool, watch manufacturer. Tr., T. H. Sheen, North John Street, and H. Bolland, both Liverpool, accountants.

Phipps, Alfred J. (Liq.), Carlton Bridge Terrace, and Golborne Road, Westbourne Park, watchmaker. Tr., A. J. Troup, 36, Hatton Garden, jeweller.

Eley, Hodson (Liq.), Boston, jeweller. Tr., C. Lucas, Boston, accountant.

Gianni, Trinette F. and **Angelo Gianni** (Liq.), Alnwick, jewellers. Tr., J. E. Wilmot, Hylton Street, Birmingham, jeweller.

Gianni, Angello (Liq.), Alnwick, Northumberland, jeweller. Tr., J. E. Wilmot, Hylton Street, Birmingham, jeweller.

Gianni, Trinette F. (liq.), Alnwick, Northumberland, jeweller. Tr., J. E. Wilmot, Hylton Street, Birmingham, jeweller.

Adjudications of Bankruptcy.

Altman, Hny. Jos., trdg. as **J. G. Joseph & Co.**, 48, Frederick Street, Birmingham, and Toronto, Canada, merchant & jeweller. Nov. 30. At C.C. Birmingham, Jan. 8 at 2, Cole, *Reg.*

Dividends.

Wheeler, Thos. (Liq.), Preston, jeweller. 2nd div. 3d.; any Thursday between 11 and 3; W. H. Brown, Burlington Chambers, Birmingham.

Dissolutions of Partnerships.

Percy, Holland & Co., 37, Great Pulteney Street, Golden Square, silversmiths. Oct. 2.

Shallaway & Graham, Leeds, jewellers. Dec. 7. Debts by Andrew Shallaway.

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R. STACKEL, HOF UHRMACHER.

This popular German periodical appears fortnightly, and may be had, post-paid, for 2s. per quarter, and 7s. per annum. Single Copies, 6d. Advertisements are charged at 3d. per four-parted line. The Journal is noted for really practical and scientific articles, and abounds with information concerning the requirements in the Art and Trade of Watchmaking. The great circulation of the same amongst Watchmakers in all parts of Germany and German Watchmakers abroad, secures for advertisements the best possible effect. Orders for Subscriptions and Advertisements at Original Prices, carried out for Great Britain and Colonies—H. Bush's Publisher's Agency, Hull, Yorkshire; and for the United States—H. Horend, 186, East Broadway, New York.

MORE SWINDLE IN THE WATCH TRADE.

THE German watch industry has considerably suffered for some time through unscrupulous dealers, who advertised watches and clocks in most of the leading papers at ridiculously low prices. Each of these swindlers had some plausible tale to tell, which was intended to account for the great sacrifices, and the ignorant public caught at the bait. A Viennese firm advertised, for instance :—" A gilt watch and chain, with guarantee, will be forwarded to any one sending 10 marks (as near as possible 10s. of our own money) to the undermentioned address," &c., &c. What has been actually received for that sum, as is known from victims, is one of the commonest black forest clocks, with brass chain as weight—an article which can be bought for about 3s. in any part of Germany. It must be understood that the Germans in general conversation use the word *Uhr* both for a clock and a watch ; and as the advertiser in this case does not specify more accurately which it is, he may, of course, send a clock instead of a watch, and still keep within the letter of his advertisement; but the chain which is to accompany the timekeeper naturally leads the public to believe that a watch is really meant. The fools who expect a warranted gilt watch and chain for 10s. have, however, nothing to complain of, and may congratulate themselves to have learnt a bit of horology so cheap. The chain is there, covered, as is the dial of the clock, with a bright bronze surface, which, with a stretch of imagination, may be called gilt. The fraud is, in fact, so ingeniously manipulated as to evade the law should any buyer choose to make his own foolishness public.

Another firm, not satisfied with fleecing the public, have added insult to injury by enclosing with their rubbish a well-executed picture of an ass, bearing the significant question, " Who is the ass ?"

Vienna, Berlin, and Frankfort produced for a long time the most conspicuous of these fradulent traders, but their audacity has been fairly eclipsed by a Parisian firm, which must have come across a good many " asses," as the proceeds of their operations are said to exceed £8,000 from German sources alone.

The following announcement relating to this firm appeared for some weeks in a number of influential German papers :—

" WATCHES AT MANUFACTURERS' PRICES.—Excellent workmanship and superior finish. Edmond Sandoz fils, Rue du Bac, 112, Paris, will, on receipt of remittance, send from his extensive and world-renowned watch factory, duty and post free, a cylinder watch, 4 rubis, heavily silvered, 5s. ; id., 8 rubis, gold-plated, 8s. 6d. ; id., 12 rubis, silver, nickel movement, 10s. ; lever, 13 rubis, silver, 12s. ; id., 15 rubis, remontoir, silver, 14s. ; id., 12 rubis, 18-carat gold, 20s. ; id., 13 rubis, 18-carat gold, remontoir, 35s. All the watches are timed, packed in leather cases, and warranted for three years. If not approved of, the money will be returned without deduction. N.B.—Not to be mistaken for the rubbishing Viennese watches."

There is no sham about this firm ; their advertisement specially notifies that their watches are not to be mistaken for the Viennese trash ; besides, the goods are warranted for three years, and the money will be returned if not approved of. Nothing could be fairer, argued the public, and a perfect shower of remittances arrived at the office in the Rue du Bac. The firm seems to have acknowledged the letters, intimating at the same time that the goods had been duly despatched, and would be sent to the customer through their forwarding agents in Hamburg. This was, however, the last that was heard from Monsieur E. Sandoz fils, wholesale watch manufacturer, of Paris. Letters flowed now in from all parts, no doubt asking for an explanation about the non-arrival of the watches paid for ; but these missives were all returned by the Paris postal authorities, endorsed with a few words which correspond to our own—*Left. No address.*

We are glad to hear that the German watchmakers' societies have taken energetic measures against these industrial pests ; and we give them due credit for the services they have already rendered to the trade and the public by exposing some of the most barefaced swindling operations.

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Ex-Director of the School of Horology at Mâcon ; Chevalier of the Legion of Honour, &c., &c., Hon. Secretary of the Paris Society of Horologers.

Translated by JULIEN TRIPPLIN, Besançon Watch Manufacturer, and EDWARD RIGG, M.A., Assayer in the Royal Mint.

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JOURNAL.
W/H TILBY

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

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HOROLOGY.

(*Continued from page* 86.)

XXXVIII.—Isochronal Adjustment of Balance Springs.—*Continued.*

It is evident that however great may be the science displayed in the inflection of the balance spring, it will be valueless, in an isochronal point of view, unless it will remain permanently in the state in which the artisan leaves it. For a spring to possess this indispensable property a high degree of perfection is necessarily required, demanding care in the selection of the material, skill in the manufacture, and science in the application. Springs are for the most part made of steel, hardened and tempered, though some have been made of gold, of which metal certain alloys have been particularly recommended, but their elasticity is not always to be relied on. The use of glass for springs was suggested by Berthoud, but was ultimately rejected.

Balance springs must possess as perfect and permanent a degree of elasticity as can be attained; these requisites depending upon the quality, hardness, and temper of the metal, as well as upon the form or shape of the spring. A soft spring gradually changes its form, and losing a portion of its elastic force, becomes unfit for use, causing the watch to lose on its rates. A hardened tempered spring, on the contrary, has a tendency to gain on its rate; but this must not be considered as a defect, since it is merely the result of the spring having been set during the process of hardening, whereby it has acquired too great a degree of rigidity; this rigidity, however, wears off after a few months' vibration in the watch, which, during this period, almost imperceptably gains slightly upon its rate, in consequence of the increased elastic force occasioned by the increased flexibility of the spring. When the process of hardening and tempering has been properly conducted, the gaining on its rate will be restricted within very narrow limits, and will entirely cease on the spring attaining its maximum amount of flexibility and elastic force.

Correctness of form or shape has been already stated as one of the conditions requisite to ensure isochronism. There are two forms of springs in use, viz., the cylindrical or helix, and the spiral or flat spring. The former is exclusively used in chronometers, and the latter in all other kinds of watches. The cylindrical, which is the simplest form of spring, is turned in by a suitable curve to accommodate it to the size of the collet into which it is fixed, and the upper end of the spring is turned in by a more or less bold sweep, according to the indication of the isochronal adjustment, and is pinned into a fixed stud. The collet vibrating with the balance, that point in the circumference of the collet, when the spring is fastened into it, is inflected through the same extent of arc as the semi-vibration consists of; and by examination of the action of the spring during the vibration of the balance, it will be perceived that for each portion of the extent so inflected, there is a corresponding increase or diminution of each of the coils of the helix throughout the entire length of the spring, no part whatever being out of action.

In order to test the isochronism of a spring the chronometer must be in good going order. If the force of the main-spring be then increased by setting up the ratchet, the arc of vibration of the balance will be increased; or, if the force of the main-spring be lessened by letting down the ratchet, the arc of vibration will be decreased, and may therefore be regulated to any extent desired. Comparisons of rate in the long and short vibrations are then made, during an equal number of hours in each, by a good clock, and the difference carefully noted, which difference indicates the state of approximation of the spring to isochronism, and points out the remedy, if it needs correction, according to the following rules:—

1st. If the chronometer be found to lose in the long arcs it will prove that the tension or elastic form of the spring has not increased to the amount due to the angle of inflection or semi-arc of vibration. Hence some minute portions of time are lost in each semi-vibration; in the first by the balance not being carried forward with sufficient celerity, and in the second by the spring not acquiring sufficient force to stop the balance at the isochronous point. The remedy in this case is to shorten the spring, thereby increasing its elastic force and causing its motion to become more rapid; but as much time is lost by repeated unspinning of the spring, the effect of shortening may be produced artificially, when the state of the isochronism is within the limits which experience points out, by merely altering the form of the upper curve, so as to give it a greater degree of expansion.

2nd. If the chronometer should gain in the long arcs, in comparison to the time it keeps when vibrating in short arcs, it proves that the tension increases in a ratio beyond that which is due to the angle of inflection. In this case, if it keeps time when the semi-arc of vibration is one hundred degrees, it will gain when it vibrates two hundred degrees; for, instead of having as much force as would compel the balance to vibrate over double the space with double the mean velocity, which would, of course, occupy the same time, it will possess an excess of tension which will increase the velocity of each semi-vibration, and necessarily shorten the time of performing them, causing an accumulation of instants, which will be the gain per diem.

The remedy for such a spring is to increase the length of the part in action; but this is not always convenient or possible in the isochronal adjustment; but an expedient is resorted to in which an artificial length is given to the spring by compressing the curve of the part bent inwards at the upper end so as to make the curve commence its inward direction at a point a little farther distant from the stud. Before attempting to make any alteration in a spring, it is advisable to examine the state of the curves, more especially when the chronometer gains in the long arcs, as it will sometimes be found that one of the curves is turned abruptly, which has the effect of causing a gain in the long arcs, in consequence of the spring abutting so directly against the curve as to leave a part of its length in very imperfect action. The opinion of early writers on the subject was, that in a certain determinate length of wire there are several isochronal points, to either of which a balance may be adapted, according to the motion of the vibrations it is intended to perform. Suppose, for instance, that a cylindrical spring having ten turns be found isochronal; one of these turns (or more) may be taken away, and a point in the spring still be found that will give the required ratio of increasing tension, and produce isochronal vibration.

The spiral or flat spring is less simple in its form than the cylindrical, and although, whatever may be its form, the principles upon which its isochronism depends are not altered, yet there are circumstances which affect its isochronal perfection in so marked a degree that this requires to be particularly noted, and the more especially so since the spiral springs are more commonly employed than the cylindrical, and their construction involves several points of greater nicety in their manipulation. The proper length and strength of wire having been selected, the manner in which it is turned up into a spiral is important, for in this operation its natural isochronism may be either partially or wholly destroyed. This will surely be the case if there be any small points or elbows in it, or if the spring be so made that during the vibration any part thereof be either inactive or have an imperfect action. Indeed, the absolute necessity for the spring to continue in free and unrestrained action throughout its entire length, and during the whole period of the vibration, cannot be too strongly urged, because an opinion generally prevails that the outer turns do not come into action until near the end of the semi-vibration. With a cylindrical spring there is no difficulty in producing the same extent of vibration on either side of the point of rest. With a flat spring, however, this is not obtained with an equal degree of facility, nor without the closest attention to its form as well as to the pinning it in, so that it shall not in the slightest degree depart from its natural shape when out of the watch.

A spiral spring, to be turned up correctly, should lie in several close turns towards the centre, springing off into a gentle curve when it is pinned into the collet, and then gradually and constantly expanding in such a manner that each part of the spiral would cross, but nowhere coincide with, a small circular arc drawn from the centre of the collet and concentric thereto. This is perfectly indispensable to isochronism. If, on the contrary, a spiral spring off from the collet, first by a large bold sweep, and then lies in a few close and large turns, it will be very defective in its action, and quite devoid of the isochronal property. In such a spring the middle of the vibrations will not coincide with the point of rest, for the spring will yield readily to the momentum of the balance during the winding-up of its coils, and the whole length of the spring will be brought into action, though imperfectly; but during the expansion of the coils, upon the return of the balance, the action of the inner turn will not be exerted against curves which lie across concentric circles, or nearly so, and will therefore abut so point blank against them as to cause no displacement whatever in a portion of the outer turns, thus giving the effect of a short, strong spring, which arrests the balance too soon in this part of the vibration. Such irregularities are obviously incompatible with the requisites for producing isochronal vibrations.

The isochronal trial of a flat spring in a watch is more simple than that described for a chronometer, since the balance of a watch is thrown into the long or short arcs of vibration by a mere change of position, which changes the amount of friction, and consequently the extent of arc. In the horizontal position, with the dial uppermost, the friction is least, and the vibrations of the fullest extent; in the vertical, or in the position in which the watch is worn, the friction is greatest, and the extent of the vibration necessarily curtailed. The trial is made by the aid of a good clock, by comparing the rate of running during a certain number of hours in a horizontal position, with the mean result of an equal number of hours running in any two opposite vertical positions. For instance, first with the 12, and then with the 6 upwards, and then in like manner with the 9 and 3 upward; the mean result of two opposite vertical positions being required in order to neutralize any slight irregularities that may exist in the poise of the balance. The indication and the application of the isochronal adjustment are the same as those already described for the cylindrical spring, but under greater restrictions; for as the balances of watches are, for the most part, unprovided with any means by which their inertia may be varied, as is done in the compensation balance, so as to suit the elastic force of any particular spring and the number of vibrations required to be performed in a given time, the spring must not only be isochronal, but of the precise degree of elastic force demanded by the particular balance to be employed. The selection of a spring in this case, within the limits of isochronal adjustment, must be made by trial in the watch.

The great advantage of an isochronal spring is its innate power of resisting the influences which cause any change of ratio—such as change of position, increased friction as the watch becomes dirty, or the viscidity of the oil in low temperatures. It is surprising to see chronometers return from sea with scarcely a change of rate, although they have been going for three or four years, and even longer periods of time, and the vibrations had fallen off to a very small arc in consequence of the oil becoming so viscid that in some instances a slight degree of force has been found necessary to draw the pivot out of the fourth hole. But what is still more remarkable, some of these chronometers, after having been cleaned, have been known to take up their original rate, although with, perhaps, three-fold vibration. The method by which an isochronal spring arrives at such perfection may be thus explained. The spring's elastic force is pre-supposed to be both perfect and permanent under similar temperatures; for, as has been previously stated, the elastic force diminishes as the temperature to which it is exposed is increased. The elastic force of the spring is counterbalanced by the resistance it meets with in the work it has to perform, which is of two kinds—the inertia of the balance, and the friction of the rubbing parts, to which all machinery is more or less subject. If the spring is assumed to possess a force equal to 100, and that 10 of those parts are required to overcome the friction when at a minimum, there will be 90 parts left for action upon the balance. But the friction will vary according to circumstances, although the spring and balance remain unaltered. If, therefore, the spring has power to carry the balance through a certain arc of vibration when the friction is at a minimum, it will have the power to perform the same amount of work when the friction is at a maximum, but the 100 parts of power will be differently proportioned in the cxecution of the work. Let it be assumed, for instance, that the friction is trebled; then there will be 30 parts expended in overcoming the friction, and consequently 70 parts only left for action upon the balance, which will necessarily have less extent of vibration. Now, since the isochronal ratio of the spring's tension remains unaltered, the commencement and end of every semi-vibration will coincide with the first and last of the minute instants of time comprising the isochronous vibration, which is the condition required for correct performance.

So it is, also, with increased friction; the elastic force of the balance-spring being constantly proportional to the angle of inflection, whatever may be the amount of friction, the law of isochronism remains unimpaired, and friction is only an adventitious circumstance, which effects the extent of the arc of vibration, but not the time in which it will be described.

(*To be continued*).

SIZE-STICK.

MESSRS. B. H. JOSEPH & CO., of 20, Frederick-street, Birmingham, have perfected a brass Size-Stick" in connection with the "Standard Ring Sizes" now so well established as the ring gauge of the trade. The "stick" corresponds with the rings to a hair's-breadth, and therefore will prove a most valuable auxiliary to the "sizes," and will no doubt meet with the same success that has already attended the introduction of the "Standard Ring-Sizes."

FORGING, HARDENING, AND TEMPERING TOOLS.

IN our June issue of last year we gave some practical hints for the performance of the above operations; but we feel sure that any additional information on this subject will be gratefully received by those who have to earn their bread by the use of tools, and who well know that the appropriateness and quality of their instruments are of the utmost importance. The following valuable directions for forging, hardening, and tempering tools were contributed to our contemporary, the *Forge and Lathe*, by Mr. J. S. Fairfax:—

If possible, one kind of steel only should be used for tools, because different kinds of steel require varying treatment, and should the brand be overlooked, the steel is likely to receive the wrong treatment, from which much vexation and loss of time may result. Select, therefore, the kind of steel which appears best suited for the work required, find out its peculiarities, and use that kind only.

Hammered steel is generally better and tougher than rolled, and more likely to stand well when used for tools. The hammering appears to bring its particles into closer cohesion, and therefore gives it a finer and closer grain, enabling it to stand more work. The angles get more hammering than the central portion, and become more refined in consequence.

Forge tools in as few heats as possible, for the quality of steel is lowered by repeated firing, and well hammer each time. Be careful not to overheat the steel, and hammer that part which would lose its heat first. Strike lighter but quicker as the steel cools, and avoid upsetting the steel—that is, striking the endways of the grain. Tools requiring re-dressing frequently, such as chisels and turning tools, should have the ends cut off after otherwise finishing them, in order to get a better quality of steel at the cutting edge. Tools are improved by heating in a charcoal instead of a coal fire.

In hardening tools use clean water, with the chill taken off, for large articles, and made quite warm for small ones. Very small and delicate tools, having a severe duty to perform, such as drills and taps, should be hardened in oil.

All cutting tools should be made as hard as they will stand; and where the cutting edge has to be frequently ground, as in turning tools, the hardening should not be done at the extreme end only, for the reason that it will be quickly ground away, necessitating reheating and consequent deterioration, besides loss of time.

Be careful, while immersing a tool in water, that it is not held stationary in the water with a heated portion in the air, otherwise the sudden contraction is almost certain to cause a crack—chisels and other thin tools being especially liable to fracture at the water-line from this cause; but dip them in a fair depth first, and then gradually deeper in the water, by which means the danger of breakage will be avoided.

Long, straight tools, such as taps, twist-drills, and the like, should be dipped endways to avoid warping, and the shank held in the tongs in order to make that part softer than the cutting edge. Many tools require to be held by wire in hardening, as the tongs prevent the ready access of water to the portion held, and consequently the hardness is not uniform.

Circular cutters and tools, which from their shape require filing to keep the cutting edges sharp, often require to be softened in order to keep up the keenness. This should be avoided as far as possible on account of the deterioration already alluded to, and also because the size is altered, which may affect the quality of the work. Where a specially-shaped grindstone or emery-wheel cannot be used, recourse should be had to a dead smooth file for putting on the desired edge, or a slip of good cutting oilstone.

(*To be continued.*)

JEWELLERY.

By George Wallis.

(*Continued from page* 88.)

AFTER the metal, which in any circumstances must constitute the structure in any article of jewellery, come the stones, real or imitation, with which this structure is decorated, or which may, as we shall see in due course, constitute the primary *motif* of the design. To enumerate the stones used would be simply to give a useless list, unless the leading characteristics of each could be detailed, which would be out of place here. It will be sufficient for our purpose to illustrate certain peculiarities of stone by the diamond, which, from its rarity and beauty, stands at the head of all gems when cut. Chemically it is a form of pure carbon. As a substance it is the hardest known, and can only be destroyed by intense heat. It is a popular mistake to suppose that diamonds are all colourless. A green diamond of perfect lustre is of great value alike for its beauty and rarity. In fact diamonds are found of various colours—blue, red, yellow, and the tints resulting from combination, and even black and opalescent.

Superficially viewed, the diamond may appear in its uncut state very much like any other crystalline substance, just as specimens of fine quartz have been mistaken for diamonds: and I may now quote some useful hints from Professor Tennant's "Lecture on Gems," as to the peculiarities of the crystalline formation of precious stones. He says: "By attending to the forms of crystals, we are quite sure that we shall not find the emerald, sapphire, zircon, or topaz, in the form of a cube, octahedron, tetahedron, or rhombic dedecahedron; nor the *diamond*, spinel, or garnet, in that of a six-sided prism, and so with other gems. For want of a knowledge of the crystalline form of the diamond, a gentleman in California offered £200 for a small specimen of quartz. He knew nothing of the substance except that it was a bright shining substance, excessively hard, not to be scratched with a file, and which would scratch glass. Presuming that these qualities belonged only to the diamond, he considered that he was offering a fair price for the gem; but the owner declined the offer. Had he known that the diamond was never found as a six-sided prism, terminated at each end by a six-sided pyramid, he would have been able to detect the fact that what he offered £200 for was really not worth more than half a crown."

Diamonds are valued by weight in *carats*, the carat being a little under five grains troy. The term is derived from the name of an African bean.

The cutting of gems is a very delicate and important operation, that of the diamond being the most difficult, from its extreme hardness and formation. It can be split by a steel tool, if the action of the tool be aimed and the blow be given in the direction of the structure. The cutting is so uncertain in its results, that diamond cutters consider the retention of one-half of the original rough diamond as a most fortunate result of the operation.

The business of the lapidary is to cut the rough gems into such forms as will best preserve their weight and enhance their brilliancy when set; and great experience, skill, and ingenuity are necessary to effect this properly. The work is long and tedious, and in the case of diamonds of large size, very costly; but still it pays for all the trouble, labour and expense, when a pure gem is properly cut, so as to bring out its peculiarities and beauty; for this is the purpose and end of the operation.

The old English method of cutting, or rather the forms in which the stones appeared when cut, is known as the single cut, or star single cut. The present fashion results in brilliants, and double cut. A table forms the upper surface of a brilliant, while the girdle of the stone is its broadest part and is generally about a third of the depth. The bezel is that part which is above the girdle, and the base of the stone is the collet, which should be two-thirds below the girdle. The width of the stone across the girdle and the depth from table to collet, when cut, should be equal; and a little consideration shows that these agree with the generic form of the gem, an octahedron, and thus as little as possible of the material has been cut away to render it perfect as a brilliant. Roses are cut in triangular facets over the contour of the stone. The brillolette is in the form of two rose diamonds placed back to back, and is used chiefly for pendants; both sides of the jewel being required to be seen.

Pearls, which are taken from marine and fresh-water shells, are composed of carbonate of lime and organic matter. They are largely used, and have always been highly esteemed from the iridescent character of their surface. Whether employed alone or in combination with stones, thus producing contrast of colour and effect, pearls are almost invariably welcome additions in the setting of a jewel. When used, as they frequently are, in large quantities, they produce in the hands of the skilful jeweller effects which other materials fail to rival.

Cameos in shell and stone are also largely used, the latter being much more costly and desirable than the former, although the shell cameos frequently permit of great variation in the detail of the subject treated, which may be executed with much refinement and high artistic finish. Small Roman mosaics, composed of very minute tesseræ of coloured stones, real or artificial, were formerly used to a great extent for setting in gold, but they have ceased to be much in demand.

Artificial gems or pastes are now manufactured chiefly in France, from a vitreous substance known generically as "Strass," from its inventor, a German. This so-called "Mayence base" is prepared from pure rock crystal or flint powder and salt of tartar, which, after due mixing and baking, is treated with nitric acid until it ceases to effervesce, the grit being washed until the water comes off tasteless. Fine white-lead is subsequently added, and then calcined borax as a flux. To the third stage of preparation nitre is added, and, on the mixture being melted for the last time, a crystal of a beautiful lustre is the result. Wieland gives a base for "Strass," which is composed of silex, potash, borax, oxide of lead, and sometimes arsenic. The colouring is obtained from metallic oxides. For instance, the sapphire is imitated by using oxide of cobalt, the oriental ruby by precipitate of Cassius, oxide of iron prepared with nitric acid, golden sulphuret of antimony, and manganese calcined with nitre, with rock crystal added to the "Strass." The emerald is imitated by using carbonate of copper, glass of antimony, and oxide of cobalt, and the yellow diamond by chloride of silver and glass of antimony. Rubies are also imitated by using manganese.

These are quoted simply as illustrations of the method by which the colour of various stones is produced with the greatest success. As a primary consideration, everything depends upon the purity and excellence of the vitreous base or "Strass," which itself, when treated by the lapidary's wheel in its uncoloured state, counterfeits rose diamonds and brilliants with great success.

The production of imitation stones was carried on with considerable success at Birmingham about fifty or sixty years ago, but under very great difficulties, by reason of the Excise laws on the glass trade. The most beautiful qualities and tints of topaz, ruby, emerald, and diamond "paste" were produced there. They are now imported more cheaply than they can be made.

(*To be continued.*)

TRADE RECIPES, &c.

(*Continued from page* 75.)

Silver Dial Cleaning.—Take about a teaspoonful of saltpetre, and mix it with about two dessert-spoonfuls of finely-powdered charcoal—willow coal is the best. Let these be ground together with a little water on a piece of slate, with the blade of a knife; then, by the aid of a camel's-hair pencil, spread a portion of the mixture evenly over the surface of the dial, which must then be laid on a piece of charcoal, and with a blow-pipe, and the clear flame of a lamp or gas jet, it must be made just red-hot, and kept so till the wet powder has ceased to fly about; it must then be thrown away from the charcoal, hot as it is, into a mixture of sulphuric acid and water (in the proportion of about one fluid ounce of acid to three half-pints of water); it will then have a snow-white appearance, and must be washed with a brush and soap in clean soft water, and put into fine sawdust till quite dry, or, what is better, rosewood raspings.

Simple Method of Reducing Nitrate of Silver by means of Charcoal.—If crystallized or fused nitrate of silver be placed upon glowing charcoal, combustion forthwith takes place, the silver remaining behind in a metallic form, while nitrous oxide and carbonic acid are freely given off. The nitrate of silver is fused by the heat developed by the reaction, and is imbibed through the pores of the charcoal; as every atom of consumed carbon is replaced by an atom of metallic silver the original form and structure of the charcoal are preserved intact in pure silver. By proceeding in this manner it is possible to produce silver structures of any desired size, possessing in every way the original form of the wood. A crystal of nitrate of silver is in the first place put upon a piece of charcoal, and a blowpipe flame is then applied in the vicinity, in order to start the reaction in the first instance, and as soon as combustion commences, crystal after crystal may be added as these one after another become consumed. The silver salt is liquefied, and penetrates into the charcoal, where it becomes reduced. Pieces of silver may in this way be prepared, of one or two ounces in weight, which exhibit all the markings and rings of the original wood to a most perfect and beautiful degree.—*Scientific American.*

To give Oak the appearance of Ebony.—The *Revue Industrielle* states that oak may be dyed black, and made to resemble ebony, by the following means. Immerse the wood for forty-eight hours in a hot saturated solution of alum, and then brush it over with a logwood decoction, as follows: Boil one part of best logwood with ten parts of water, filter through linen, and evaporate at a gentle heat until the volume is reduced one-half. To every quart of this add from ten to fifteen drops of a saturated neutral solution of indigo. After applying this dye to the wood, rub the latter with a saturated and filtered solution of verdigris in hot concentrated acetic acid, and repeat the operation until a black of the desired intensity is obtained. Oak stained in this manner is said to be a close as well as a splendid imitation of ebony.

Gilding and Plating (Continued from page 89).—To prepare the gold solution make a saturated solution of cyanide of potassium as before, and pour off this solution upon the contents of a fifteen-grain bottle of chloride of gold until the latter is quite dissolved; then dilute with water in the same ratio as in the silver electrolyte—that is, one part of the solution of chloride of gold in cyanide of potassium, with three parts of water. This solution filtered forms the gold electrolyte.

Mounting the battery for plating or gilding is the next operation. If the article or articles to be plated or gilt are small a single element will, in all probability, be sufficient to produce the requisite amount of electric current. Place the zinc in the middle of the tumbler, then insert the earthenware cell in the zinc, and holding it down with the left hand, pour into the tumbler dilute sulphuric acid until it reaches to the upper rim of the cell. The cell itself is next filled with concentrated nitric acid. The plate or strip of platinum is finally inserted in the nitric acid. The zincs are generally amalgamated when you buy them; if this operation has been omitted, you can do it yourself by rubbing over the moistened surfaces a cloth dipped in nitrate of mercury. Place one connecting wire in the zinc binding screw, and the other in the platinum binding screw. The zinc wire is the negative pole, and is frequently called the "zincoid," whilst the platinum wire is the positive pole, denominated the "platinoid." At the end of the negative wire the object to receive the deposit is placed by suspension on a hook, or otherwise, in metallic contact, and then immersed in the electrolyte. The plate on the positive hook is likewise immersed in the *same* solution, and brought near to the object, *but on no account in contact* with it. The electric current now circulates because the circuit is complete, passing along the positive wire to the plate at its end, where it comes in contact with the metallic solution between it and the object connected with the negative pole. This solution, consisting of water and a metallic salt, is decomposed by the circulating current in the following manner:—The water is decomposed into its elements, oxygen and hydrogen, which, being separated, rush in opposite directions, the hydrogen towards the object, whilst the oxygen affects the positive pole or plate; and the metallic salt, infinitesimally divided by solution, is also broken up or decomposed into its elements; thus the chloride of silver is separated into silver and chlorine, the latter affecting the positive pole, whilst the silver is deposited on the negative pole. Take out the object from time to time and examine it. If the coating is purely white (if silver), or purely yellow (if gold), the operation is going on right, and may continue until the requisite amount of deposition has been obtained. By this means the metallic film thus deposited may be made of any thickness whatever. Sometimes, however, this metallic film is not pure of its kind; on the contrary, it is oftentimes granular or crystalline, and at others quite black. To prevent these irregularities is the chief care, and much experience and patient study are required before the best conditions can be obtained at once. Changing the distance between the two poles, moving the positive pole about, increasing or diminishing the thickness of the positive wire, warming the electrolyte, diminishing or increasing the number of elements in the circuit, these and other operations are at times necessary; when to perform them experience alone can teach. As soon as the object has received the required thickness of deposit, it is taken out of the electrolyte, washed, dried, and burnished on those parts which are to appear brilliant, whilst the remaining parts remain dead and frosted.

The operation of plating or gilding over, the next care is for the apparatus. The dilute sulphuric acid, once used, is thrown away; but the nitric acid is poured back into the stock bottle, for future use. The latter has, however, undergone decomposition during the operation, and has become diluted with water formed by the elements liberated during the circulation of the electric current through the sulphuric acid and nitric acid, and in consequence of this gradual dilution, the nitric acid becomes in course of time too much impoverished for use and must be replaced with concentrated acid. Place the porous earthenware cell in a dish of water when it is emptied, as also the zincs, for an hour or two, then remove them to drain dry.

(*To be continued.*)

Prices Current for Gold and Silver.—Value Given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver 4s. 6½d. to 4s. 9d. (variable according to quantity).

HINTS TO REPAIRERS.

(*Continued from page* 90.)

BALANCE pivots and other pivots, running in cap jewels, can be made much thinner and yet much stronger than ordinary pivots by making them conical. Not only are conical pivots stronger, but are also more elegant in appearance than straight pivots. To make conical pivots the repairer must provide himself with some pivot files and a pivot rest for his lathe; these extras he must construct himself (they not being sold in tool shops), in the following manner:—The pivot files being the first consideration, the repairer must provide himself with three pieces of long and flat steel, or three old pivot files—one for filing, one for grinding, and one for polishing the pivot. The first-named file is first heated to a cherry red, and left to cool slowly: the edge to which the workman is accustomed to file with is filed to exactly the shape for filling the cone of the pivot when in a finished state; the file marks are then ground off, by grinding with a piece of copper plate and oil-stone dust with oil; then provide a punch (such as is used by chasers, and can be bought at any tool shop), whose face presents the appearance of the cuts on a file—the finer the cuts on this punch the better; the ground edge of the file is then chased with this punch, held lightly above the file, imbedding the file marks transversely the whole length of the file, and is then hardened and tempered to a light straw-colour.

The next file, or the one to be used for grinding, must also be softened, and must have the edge filed exactly the same shape of the first file, and is also to be ground, but in a direction perpendicular to its length, and is then hardened and tempered to a dark blue colour. The third file, or the one to be used for burnishing, is also softened, and must also have the edge filed off to exactly the same shape as the first file, and is ground, first with a piece of copper plate with oil-stone dust and oil, and lastly with a piece of type metal, with very fine oil-stone dust and oil, care being taken to grind in a perpendicular direction to the length of the file.

The next consideration is the pivot rest for the lathe. A piece of good English cast steel is selected that will exactly fit the hole in the lathe for the reception of the pivot rest; this rest is provided with a notched wheel, whose object is to keep the rest in a rigid position while the repairer is at work thereon; the front part of the rest is then turned, so that a head is left standing, whose breadth should be twice the length of a pivot; this head is filed into a number of flats, corresponding to the number of notches in the wheel at the back of the rest, care being taken to file these flats exactly perpendicular to the point opposite in the lathe, when a notch at the back of the rest is in check by a piece of steel fastened into the base of the lathe; different-sized notches are now filed into the flats in a line with the point in the lathe exactly opposite. The fronts of the notches are now rounded, corresponding in shape to the cone on the pivot when in a finished state, which is done in the following manner: A perfectly round file is taken, pointed and provided with a collet, and placed in the ordinary turning lathe; the file is set in motion, and the edge of the notch in the rest is brought to bear against it; the rest, meanwhile, being slightly moved up and down, until the notches have the proper shape, viz., corresponding to the shape of the pivot when finished; the notches are then ground and polished, by substituting a round piece of iron wire, with oil-stone dust, for grinding, and a piece of zinc-wire, with diamantine and alcohol, for polishing. The rest is then hardened and tempered to a light straw-colour. Now the pivot, being turned to very nearly the shape it should have, is placed in the pivot lathe, so that the front of the the pivot rests solidly in the notch on the rest, allowing the cone of the pivot to come as near as possible to the rest. The first file is then introduced, and the pivot filed until the pivot is very near the proper diameter; the grinding file is then taken, and the pivot ground with very fine oil-stone dust, and lastly the pivot is burnished with the burnishing file. A little practice will enable any one to make a very nice conical pivot. In the above description the style of pivot lathe supposed to be used is the ordinary Jacot lathe, they being the most handy. When the pivot lathe differs in style from the Jacot lathe, the above description of appliances will, of course, not apply, but the workman will certainly have ingenuity enough, from the present description, to substitute the required changes.

To polish the face of a pinion requires a little tool that can easily be made, thus: A piece of brass is filed into the shape of a T, with this difference, that the two short ends are bent up, and on these ends two screws are adjusted; between these, and running on these two screws, is a little brass piece, through which a hole is drilled, the hole being sufficiently large to hold little chucks, made of soft iron and brass, which also have a small hole drilled through them; the brass piece must be able to revolve freely between the screws. Now, when the face of a pinion is to be polished, one of the little iron chucks is set into the brass piece, the tool held in the left hand, and the staff of the pinion is put into the hole (the hole being a little larger than the diameter of the staff of the pinion) so that the face of the pinion rests against the side of the chuck, and the other end of the pinion held against the vice; a little oil-stone dust and oil is applied to the pinion, which is set in motion with the drill bow, and ground until a true flat is attained; the iron chuck is then replaced by one of composition, a little diamantine applied to the pinion, and set in motion in the same manner, until the pinion is nicely polished. The chuck, accommodating itself to the face of the pinion (it hanging on two pivots or screws), must necessarily produce a true flat.

(*To be continued.*)

LUMINOUS CLOCKS AND WATCHES.

SINCE our last we have had the pleasure of inspecting specimens of these ingenious and useful additions to our horological products, the invention of Mr. W. H. Balmain, and secured by letters patent, dated November 7th, 1877. This is an English invention, and quite distinct from the luminous dials exhibited at Paris.

The dials are rendered luminous in the dark by an application of a phosphorescent substance, obtained by heating together lime and sulphur or carbonate of lime and sulphur. The mode of application varies. Mr. Adolphe Aron, of 4, Rose Street, Newgate Street, E.C., and who works Balmain's patent, makes two sorts of dials—the one consists of two glass plates, with the compound inclosed between them, the numbers are printed on the front glass, and remain black when the substance becomes luminous in the dark; the other is made of cardboard, over which the phosphorescent substance is brushed, after having been previously mixed with a colourless varnish. The figures are painted over the dial thus prepared. The card-board dials are specially recommended by the patentee for the brightness and durability of the luminosity. The substance employed by this firm retains its luminous power for a considerable time, and a clock in their possession made nearly two years ago is at present as powerful at night as ever. We have much pleasure in bringing these articles before the trade, as they will certainly meet with a ready sale.

MODERN CLOCKS.

THAT sovereign power, fashion, invades nowadays almost every branch of industry, and the manufacturer and dealer who means to do business must keep pace with it. It is true that fashion does not always mean progress, and that its application to some of our productions is even injurious; but its demands will be heard and must be satisfied. It is equally certain that the public has become more fastidious; the useful must in these art days be combined with the beautiful. No one has more readily understood and profited by these altered circumstances, resulting from improved education, than the French, and we might take many useful lessons from them. Let us take, for instance, clocks. The trade knows very well to what enormous proportions the importation of French clocks to this country has grown. Is it because French clocks are better than our own? By no means. Speak of the clock as a *time-keeper* and we are unrivalled; but let us compare the exterior of a French and an English clock, the only part of which the general public is capable of judging, and we shall cease to wonder why an Englishman, who loves to surround himself with objects of beauty, gives preference to the former. Who can help admiring the beautiful and often artistic productions in ormolu, bronze, marble, alabaster, &c., which Paris spreads before our eyes with such profusion, and in such variety of style as to meet the wants of almost any taste? It is true that the French, in their perpetual hunt after novelty, often create monsters instead of works of art, that their common ormolu clocks are more fit for the glitter-loving South-Sea Islanders than for a refined nation, and that a showy exterior often covers a wretched movement; but their superior class of goods display a steady progress; they are a credit to the makers and worthy the estimation in which they are held.

Much of the money which now goes to France for our clocks might be secured to our own clockmakers, were they to bestow more attention to their cases, and offer the public a clock which is not only a good time-keeper, but also an ornament fit for the mantel-piece. The early English style of clock cases now sold in the better-class shops is certainly a great improvement, and very suitable if matched to a suite of furniture. Unpretending as they are, they were much admired at the Exhibition, together with our artistic but sober-looking cabinet work, and formed a pleasing contrast to the shining mass of gilt clocks in the French section.

Attracted by some magnificent clocks in the show-room window, we entered the establishment of Messrs. Thompson and Vine, watch and clock manufacturers and importers, of 118 Aldersgate Street, with a view of gratifying ourselves with a closer examination of the handsome specimens which called our attention. A member of this well-known firm kindly granted us permission to inspect their stock and workshops, a privilege of which we gladly availed ourselves. The elegant premises of the firm, which were specially built as a clock factory, are admirably arranged in every respect; lighting, heating, and ventilation are perfect, and the appliances in every department most suitable. The various operations of watch and clock making are carried on in separate floors, but they need no further description, as the general arrangements correspond with those of any similar establishment.

Messrs. Thompson and Vine manufacture every variety of clocks and watches, and we saw some chiming and striking clocks of their make which fully bear out our assertion, that a carefully and conscientiously constructed English clock remains unsurpassed. Among the productions of this firm which deserve special mention are their marine lever timepieces, some of them striking the watches as kept at sea; their lever alarums in polished metal cases, and a small lever time-piece (a speciality of the firm) of very simple construction, an excellent time-keeper, inexpensive, and very neat when suitably cased.

The show-room is in itself a complete exhibition of clocks, as besides the numerous productions of the firm, there are to be seen contributions from every clockmaking nation. What we have already said of the clock cases of the French, comes here again vividly before us, the more so as the collection offered here has been most judiciously selected. The goods, including a tasteful array of superior jewellery, are admirably displayed, no small advantage in making a selection among such a varied and extensive stock. We may add that Messrs. Thompson and Vine also supply watch tools and materials, and that repairs for the trade are executed by an efficient staff under the personal supervision of Mr. Thompson.

HALL-MARKING IN AMERICA.

IN consequence of misinterpretation of Mr. A. Bedford's (the London representative of the American Watch Company) evidence before the Select Committee on Hall-marking, the erroneous impression got abroad that a Hall-mark would find favour in the United States, and Mr. Prideaux, clerk of the Goldsmiths' Company, actually made such a statement, based on that gentleman's evidence. Nothing is, however, farther from the intention of the American jewellers and silversmiths than the introduction of a Goldsmiths' Hall; and we have already stated, on the authority of some of the leading members of those trades, that they consider absolute freedom from government control as essential to their progress and prosperity. We have since received several communications from the United States, expressing astonishment that the representative of a large American firm should have made such a statement on behalf of the precious metal trades of the States; the fact, is, however, that Mr. Bedford's evidence has been entirely misunderstood by some, and misapplied by others. A letter in our December issue was intended to show the matter in its true light, but as it does not appear to have removed all false impressions, we are authorized by Mr. Bedford to clearly state the case again.

When we consider the "Watchcase Makers' Bill" before the Committee, which excludes the Hall-marking of foreign watch-cases altogether, we think it but natural that the representative of the largest American concern in the trade should come forward and deem it his duty to oppose such prohibitory measures. This clause in the Bill brought Mr. Bedford before the Select Committee, and *it is to the Hall-marking of watch-cases alone* that his remarks were intended to refer; in fact, he was at first quite unaware that the Bill embraced any other question. He certainly stated, that they (the American Watch Company) would like to have a Hall-mark for the protection of the maker. This is, however, simply meant for watch-cases; and a Hall-mark corresponding with our own would, no doubt, materially assist that Company, as under present arrangements they are obliged to have the cases sent here to be stamped, and then returned to the States to be finished, a proceeding which must add a considerable per-centage to the cost. The Company does not require a Hall-mark for the States, as their own name is ample guarantee there for the genuineness of their goods, but they desire a mark for the English market, so as to be on the same footing as English makers. In short, Mr. Bedford was before the Select Committee as the representative of the American Watch Company in the interests of their *English* trade, and not as the spokesman of the jewellers and silversmiths of the United States.

We consider ourselves bound to give this explanation, as the advocates of the present Hall-marking system place great importance on Mr. Bedford's evidence, and, as already stated, interpreted it to suit their case, although it had not the slightest relation to that subject.

CURIOSITIES OF CLOCKS AND WATCHES.

(Continued from page 79).

ABOUT the year 1696 Burdeau, a clever mathematician constructed a remarkable clock in compliment to Louis XIV., whom in this ingenious work he highly flattered. On a rich throne, surrounded by all the pomp of royalty, was seated le grand Monarque, around him stood the electors of the German states, and the princes and dukes of Italy. These advanced towards the king, and, after doing homage, on retiring chimed the quarters of the hour with their canes. For the kings of Europe was reserved the more dignified office of striking the hours, after having paid their respect to the king. This piece of automaton clockwork was very gratifying to the French people of the time of Louis XIV., and many who admired it persuaded the maker to exhibit it publicly. Unfortunately for Burdeau, he advertised his intentions to do so in the newspapers, and attempted too much in order to gratify the great crowd of people which collected in consequence. Knowing the stubborn and unyielding will of William III. of England towards his sovereign, the artist determined to make William's effigy more pliant, so that when its turn came it should make a very humble obeisance to Louis. William, thus compelled, bowed very low indeed; but at the same instant some part of the machinery snapped asunder, and threw "le grand Monarque" prostrate from his chair at the feet of the British king. The news of the accident spread in every direction as an omen; the king was informed of it, and poor Burdeau was confined in the Bastille.

In the palace of Versailles, in the Salon du Conseil, is a curious clock, that plays a chime when the hour strikes, and is set in motion by machinery, by which also sentinels are made to advance, a cock to flap his wings, Louis XIV. to come forward, and a figure of Victory or Fame to descend from the skies and crown him with a golden chaplet. The Salle des Pendules in this palace is so called from a clock in it which shows the days of the month, the phases of the moon, the revolutions of the earth, and the motions of the planets, besides the hour, the minute, and the second of the day.

In 1820 appeared the following advertisement:—"Mechanical clock. The proprietors of an elegant and superb Mechanical Clock, eight feet high, which was the property of Maria Antoinette late Queen of France, have the honour to present it for the inspection of the public; this piece of mechanism represents the front view of the king's palace at Versailles (the garden side); on the commencement of striking the hour, a complete and beautiful clockwork begins playing twenty different airs, after which a figure, representing the Warner of Death, makes its appearance in the centre of the balcony, at each side of which is a King's Herald in a sitting position, holding the shell of a clock in their hands, to which the figure moves alternately with a majestic step, striking the hour, and then retires; immediately after five doors in the balcony open, and out of the centre his Majesty Henry IV. makes his appearance by announcement of trumpets by figures at each side of the balcony, when the doors close again and leave his Majesty in a standing position, surrounded by his suite; then an angel from the top, with a crown in his hands, appears, in the midst of music by different instruments, placing the crown on the head of the monarch, with a brilliant star hovering over his head; at the conclusion of the coronation and music, the trumpets recommence sounding, when his Majesty salutes the public and retires with his suite; and the doors immediately close. The dial of this incomparable piece of mechanism represents the different movements of the globe, the sun, moon, and planets, showing the leap year by the months, weeks, days, hours, and minutes, with the four seasons; the whole of which is regulated by the movements of this extraordinary mechanical clock. At the same place may be seen also the Cuirass of his late Majesty the Emperor Napoleon, with the Cuirass and Helmet of his son, the King of Rome; and many other new invented cuirasses. All the objects are to be sold, and are on view at No. 23, Howland Street."

In the court called the Cour de Marbre at Versailles, was a clock that had no mechanism, and only one hand, which was placed at the precise moment of the death of the last King of France, and, which did not move during the whole of his successor's reign. This custom dated from the time of Louis XIII. It was a fitting memorial for a palace, to remind the inmates of their brief tenure of office. In 1838 this "clock of the King's death" was replaced. In the Imperial chateau of St. Cloud, in the Salon de la Réception de la Reine, is a clock with twelve dials, marking the hours of as many capitals of Europe.

The first equation clock, an ingenious contrivance to show both mean and apparent time, was made in London between 150 and 200 years ago. The first one invented was in the cabinet of Charles II. King of Spain, and is thus described in a letter from Father Kresa, a Jesuit, to Mr. Williamson, a watchmaker:—"I have to tell you that from the years 1699 to 1700 there has been in the cabinet of King Charles II., of glorious memory, King of Spain, a clock with a royal pendulum, (seconds pendulum), made to go with weights and not with springs, going four hundred days without requiring to be once wound up. . . . I had orders to go every day to the palace during several months to observe the said clock and compare it with the sun-dial: and at that time I remarked that it showed the equation of time equal and apparent, exactly according to the tables of Flamstead." In the "Philosophical Transactions," 1719, is a letter by Joseph Williamson, a watchmaker, asserting his right to the curious invention of making clocks to keep time with the sun's apparent motion. The principal artists who were employed in the making of clocks to show not only mean but also apparent time, a more curious than useful part of horology, were Sully, Father Alexander, Le Bon, Le Roy, Kriegseissen, Enderlin, L'Admiraud, Passement, Rivar, and Graham. The difference between the hour shown by the sun-dial and by a correct clock is called the equation of time. In order to obviate the inconvenience produced by this irregularity, astronomers imagine a fictitious sun, coming to the meridian as much before or after the real sun as the equation of time is after or before noon; and as this fictitious sun is supposed to move in a course that is the average, or mean, of all the irregularities in the motion of the real sun, it is called the mean sun, and the time it indicates mean time. An astronomical clock is one contrived to show the apparent daily motions of the sun, moon, and stars, with the times of their rising, setting, and the like. The reader will remember that the motions of the sun and stars round the earth are only apparent, and are produced by the real motion of the earth in rotating upon its axis, which motion is uniform and unvariable.

In the church of St. Mary, Warwick, which has a set of tuneful chimes, is a large wooden clock, fixed to the wall on one side, at the west end, showing the day of the month, as well as the time of the day. Upon its smartly-painted face are the arms of Queen Anne and her motto, "Semper Eadem," (Ever the Same); and also the admonition, "Vigilate et Orate" (Watch and Pray).

(To be continued.)

"I DON'T want a watch that ticks so it can be heard," said a man to a watchmaker. "I want my watch under my pillow at night," and if it goes tick tack, tick tack, it keeps me awake." "Ah," said the watchmaker, "you want one of 'The Silent Watches of the Night.' We don't keep 'em."

BRONZES.

By C. D. E. Fortnum, F.S.A.

Continued from page 93.

THE method of producing the finest brass is by reducing calamine to powder, sifting and washing; it is then mixed with charcoal and calcined; again pounded with charcoal, it is mixed with the requisite quantity of copper in the form of shot. Tightly pressed into a crucible and luted down, it is exposed to a strong heat for the purpose of melting the copper, which, combining with the disengaged zinc, is poured into iron ingot moulds in the state of liquid brass. Variations of this and of other methods of fabrication are adapted in Germany and elsewhere.

Before inquiring into the ancient history of works, either beaten or cast, it may be well to give a brief description of the more common and general process adopted for casting a statue or other object of considerable size in bronze. When lightness is requisite, as also usually with the view to the economy of metal, such works are not made solid, but are cast over a central and removable core. To make this is the first care, and accordingly it is built up to the rude outline, but smaller than the statue or other object to be moulded upon it. A material is employed, composed generally of modelling clay, mixed with pounded brick and plaster of Paris, in proportions varying with the circumstances, and the experience of the artist. When fashioned, it is slowly and carefully dried, the last moisture being driven from it by baking in an oven. Upon this core, which must necessarily correspond with the artist's conception or design for the work he is about to model, and which, in the case of a large statue, is further supported by iron bars and framing, modelling wax is overlaid of a thickness in accordance with the requirements for strength, and having regard to size, action, etc.

The sculptor now works upon this wax, modelling his figure to the utmost of his art, and with all the elaboration which he wishes to bestow upon the details. It is, in fact, the finished statue as it leaves his hands, but of wax, to be replaced by bronze. Outside this the mould has to be formed, and here also the greatest care is necessary that every minute detail shall be filled in with the composition, without the slightest disturbance to the form, or abrasion of the finished waxen surface. For this purpose the mixture must be somewhat liquid and evenly applied, care being taken that no air be left in bubbles. It is generally a composition of dried clay and pounded crucibles with some plaster of Paris intimately mixed, ground, sifted, &c., and rubbed up with water to the consistence of cream. This is first washed upon the surface in a thin coat penetrating every minute intaglio, and then gradually, as it dries, thickened by other layers until a sufficient substance be obtained. Upon this, again, a stouter coating of coarser quality must be formed to sustain the inner mould and bear the weight of metal. Small rods of bronze have also been previously inserted in the core, which standing out through the wax, will leave their other ends imbedded in the mould; the object of these is to sustain both core and mould in their relative positions, without the slightest movement, when the wax form has been melted from between them. The whole, after slow and careful drying, is then firmly fixed in proper position within an oven specially prepared; fire is kindled till the mass is heated, and the wax which was within has flowed out in a liquid state from every corner. Ducts or rents have been made in various places to permit the escape of air, when the liquid metal shall be poured in. We thus have left, thoroughly baked and to be firmly fixed in the casting pit, bedded in sand, the outer mould within which the core is steadily sustained, and between them the now empty space which represents the statue. Meanwhile the metal has been duly mixed and fused in its proper furnace, the requisite "ingates," or conduits, have been formed, and the critical moment has arrived.

Who that has read Cellini's graphic account of his difficulties in the casting of the Perseus will not sympathise with the anxieties of the artist, directing all these operations by his own mind and working at them with his own hand? Who cannot enter into the spirit of this exciting moment in reading Schiller's vivid word-picture of the founding of the bell? The bath of metal glowing like sun-lit gold, is tapped, and the liquid steadily pours into the mould, filling every line and detail which the wax had occupied, closing the ducts by which the air was forced sighing from before it, rising in the vacant space which, open to receive, is now gorged to the full—enough! the bronze is cast, and we may rest. But woe betide if any moisture has remained within the core of the mould, or, if the air rents are insufficient for its escape, mixed with the gaseous emanations from the melted metal; the mould is rent, the work is spoiled, and the liquid fire is vomited forth in scalding showers among the unhappy workmen.

After cooling, the mould has to be broken carefully away, the core raked out, and all projections (as of the rods inserted to connect the core and mould), superfluous metal from the ducts and conduits, and asperities in general, must be removed. The artist's model is there before him, not in wax as he left it but in a more enduring form. This is the process known as "à la cire perdue," the almost constant practice for small and for large works by the artists of the Renaissance and earlier ages.

Should the work, however, be required in duplicate, or the cast from an existing statue be desired, or, as in casting of smaller works, many times repeated, other methods are to be employed. In the first case, a cast in plaster of Paris made in divisions must be taken from the model, which may be of clay, and sheets of moulding wax are then carefully pressed into every interstice and hollow of the mould, and kept of even thickness. Generally beginning at the feet, the mould, statue, and core are thus built up together, jointing the pieces of the former as they are lined with wax, and filling in the middle with a semi-liquid composition to form the core. For larger works the present method is to build up the mould, lining it with modelling clay of the thickness required for the metal, inside which the core is also built up; the mould is then detached in pieces, and its clay lining being removed, is again set up in the same position, leaving an empty space between it and the core, which the liquid metal is to fill. For smaller works, to be frequently repeated, a more permanent mould is adopted, formed upon a carefully executed model or pattern-piece.

(*To be continued.*)

FRENCH BRONZES AT THE EXHIBITION.

THE foreign critics are not unanimous in their appreciation of the French bronze exhibits. Simplicity of design is lost sight of, it is said, though the work itself may be well executed. Silver, bronze and jewellery manufactures have hitherto been three French specialities. There are signs, however, that the same superiority cannot be maintained. Japan has made a very fine exhibit of bronzes. The imitations of Chinese cloisonné are often spoiled by wanting the character of the original. The great clock by Barbédienne is cited as a proof of this tendency to over-ornamentation. Greek, Gothic and Renaissance styles are mixed up, while towers and gables and marble and enamel are all brought into requisition. In chandeliers there has been more improvement exhibited. Cloisonné and Japanese metal decoration, and gold and silver ornament on black ground, and porcelain painting, have been utilised to the best effect, but the designs do not exhibit the artistic taste which can only make such articles really things of beauty.

THE PLACE OF JEWELLERY IN ART.

A Paper read at the Social Science Congress, Cheltenham.

By Edward J. Watherston,
Member of the Society of Arts.

(Continued from page 95.)

THE thought here, if inspired by different motives, is precisely that running through the whole of Greek art. It is, that all personal ornaments should be designed solely to increase the beauty of the human figure, and that it is barbarous to make them mere exhibitions of wealth. In other words, all that we designate under the general description of *Jewellery*, including gold and silver-smith's work, made for personal adornment—a word derived from the French "joyau," something productive of joy,* but which the Germans call "Geschmeide," from "schmieden," to forge, pointing to the origin of the goldsmith's art—should be, above and before all, the produce of art. That such art produce has a specific value, on account of the raw material of which it is made, ought to have nothing whatever to do with this primary consideration. A bare, or ugly, lump of gold around the neck or arm is no more a piece of jewellery than a lump of lead.

That those entirely false notions respecting the actual *value* of jewellery, which are largely prevailing in modern times, should have arisen, is, it must be admitted, not quite the fault of the public. Art in jewellery has not advanced but retrograded, chiefly because we have had no artists. Like painting and sculpture, the art of the goldsmith and the jeweller is a peculiar combination of artistic knowledge in design and of mechanical skill in execution, which apparently it takes generations to develop. In many countries of the East the art is still hereditary, its craft and mysteries descending from father to son. A French lady descended from Indian parents showed Mons. Philippe Burty,† in Paris, some years ago, a magnificent set of necklaces and bracelets, made by itinerant workmen of what we should deem the lowest class. She explained that every year, at a certain season, four thinly clad men, having the appearance of gipsies, came and established themselves in a little tent opposite her father's house. They were wandering goldsmiths, and known as such. Trusting to their skill, four, five, or six ounces of gold, carefully weighed, were handed to them, with orders to fashion them into necklaces or any other desired ornaments. They set to work with what seemed to be the rudest tools, fixing a small anvil into the ground, with a little charcoal fire at the side, and then hammering, chiselling, and soldering with endless vigour, intently bent upon their labour, and apparently caring for nothing else in the world. Every morning a few handfuls of rice were given to them, on which they lived, with nothing else but water from the neighbouring fountain. At the end of a fortnight, or sometimes a little later, according to the amount of work, they struck their tent, delivering up the jewels they had manufactured, for which they received trifling pay, and then moved off with stoical indifference, going to labour at some other door. The jewellery thus manufactured was described by an eminent Parisian art-critic as something perfectly marvellous, and such as altogether beyond the skill of the most eminent masters of the goldsmith's art in Europe. The threads of gold in the necklaces and bracelets were hammered out to a degree of thinness and suppleness which defied all comparison with European workmanship; yet the whole work at the same time was of extraordinary strength, not one of the threads, fine as gossamer, and barely visible singly to the naked eye, having given way in the course of twenty years. It seems not improbable that of such stuff as these wandering goldsmiths of India were many of the artists of like occupation in ancient Greece.

Of the hereditary element in this branch of art, a striking illustration is furnished by the experience of the well-known Roman jeweller, Signor A. Castellani. Himself the son of an accomplished goldsmith, fond of studying ancient art, his attention was drawn, early in life, to the exquisite beauty of those ornaments manufactured in what is known as the "granulated" style, the articles consisting of vast numbers of embossed gold pieces, small as grains of sand, soldered together in a way defying all modern manipulation. Signor Castellani made numerous trials to discover a method of executing similar work, but with no result, and after many years of hard labour he acknowledged his own complete failure to accomplish what the ancients had evidently done with the greatest ease. Then a friend suggested to him that the workers of ancient Etruria, famed for their technical skill in all the arts of Greece, might possibly still have left descendants on the spot, and acting upon this hint Signor Castellani went on a tour of investigation through Southern Italy. Marvellous to relate, he actually found what he sought in one of the most solitary spots of the country formerly known as Etruria, a little place called St. Angelo, in Vado, hidden in the depths of the Appenines, almost unapproachable by road, and literally cut off from modern civilization. There were men at St. Angelo, as well as a few women, who had not yet, after the lapse of thousands of years, forgotten the cunning of their forefathers. Signor Castellani brought some of these men to Rome, where they set to work under his own eyes, manufacturing jewellery in the ancient granulated style. They did so by a method not known to him, using soldering of a new kind, eschewing all punching and casting, and giving, on the whole, great satisfaction to their employer. Still he confessed in a memoir presented to the French "Académie des Inscriptions et Belles Lettres," reciting his experiences, that his Etruscan workmen, skilful as they were, remained still much behind the ancients. They could not execute many of the more intricate parts of Greek jewellery common in all existing specimens. "I am convinced," Signor Castellani expressed himself, "that the ancients must have had some chemical process, now lost to us, by which to fix many of the interlacings in their ornaments. Not possessing it we have not been able, notwithstanding all our efforts, to arrive at the reproduction of certain articles of exquisite minuteness, which we despair of ever imitating, unless through the agency of some new scientific discovery." Like many others, Signor Castellani here went clearly too far in his admiration of Greek art. He thought of nothing but "imitating," and it seemed beyond his range of vision that there was such a thing as creation. Yet the study of ancient art, however desirable it may be, will assuredly not by itself give rise to originality. Was there ever a man who became a poet simply by copying out the best poetry written by others before him?

There is one point in connection with personal ornament, comparing ancient and modern productions of art, which is much overlooked. It is that, while the goldsmith is one of the oldest of artisans—it being probable that gold was forged even before iron, or at least simultaneous with it—the jeweller, properly so-called, is of modern origin. The ancient Greeks, Etruscans and Romans, it is true, largely used stones for their ornaments, but they did so in a rough way, apparently caring for colour more than lustre, and subordinating both entirely to the design, represented by the metal work. It was not till towards the middle of the fifteenth century that the art of cutting precious stones into "facets," so as to exhibit their utmost lustre, was discovered, or at least practised. Resplendent as are the beautiful objects thus made, to show their most refulgent light, it is not quite certain that the discovery has been an unmixed benefit to art. If it is admitted that the main object of all personal adornments is to increase the natural beauty of the human figure, or, what is the same, make up for any deficiencies, whether in form or colour, the skill of the lapidary often may prove a danger rather than an actual advantage. A pale beauty, oval-faced, with a tiara of blazing diamonds on her head, is not improved in appearance by the "brilliants" made by cunning Dutch hands, but quite the contrary. Perhaps the Greeks understood the harmony of colours quite as much as the symmetry of form, and for this reason left the precious stones, whenever employed in personal ornaments, very nearly in their original state, only giving them polish, and eschewing, even if attainable, the too bright light obtained by our artificial "facets."

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* Finely expressed in Keats' famous line, "A thing of beauty is a joy for ever."

† Author of "Chefs-d'Œuvre des Arts Industriels."

(*To be continued.*)

OUR LITERATURE.

Where would astronomy be without the astronomical clock, or navigation without the chronometer? It would require volumes to adequately describe the services horology has rendered to science and humanity; but strange to say, that while books, numerous enough to fill libraries, have been devoted to useless speculation, the records of this fruitful science are most limited, especially so in our own language. Our great masters and benefactors, such as Graham, Harrison, the two Arnolds, Mudge, Earnshaw, &c., have certainly left us an account of their labours, and several of our modern horological lights have made valuable contributions towards our scanty stock of literature; but a thorough treatise, embracing all the branches of horology, capable as an instructor and guide to develop our future Grahams and Harrisons, we have not.

We may here incidentally mention that an appeal has been made to restore the tomb of Harrison, and it says but little for our gratitude that such an appeal should be necessary at all. We delight to honour our glorious soldiers and statesmen, and why should we not pay equal homage to those who, while walking in the paths of peace, have been instrumental in raising the industries which are our wealth? Many men less deserving of their country than Harrison lie buried in Westminster Abbey.

French and Swiss watchmakers have been more fortunate as regards literary assistance, as many of the eminent horologists of these countries have published their experiences for the benefit of their fellow-craftsmen. The latest, the most complete, and the most reliable of these literary productions, in fact, the book of books, is Mons. Claudius Saunier's "Traité d'Horlogerie Moderne." Here we find in a collected form all that our predecessors have thought and created, their beautiful inventions divested from the errors, false notions and prejudices that clung to them, and what was often mere speculation reduced to facts. One of the leading characteristics of this work is its perfect trustworthiness; there are no assertions based on vague hypothesis, everything rests on the logically-applied laws of motion, and is corroborated by well-established experimental data. Another valuable feature is the strict impartiality displayed everywhere. Mons. Saunier is evidently a man of large views, entirely free from prejudice, and who can appreciate genius from whatever part of the world it hails; at the same time he spares no one, he accepts nothing without proofs, and fallacies he exposes without regard to persons. We need hardly say that these gifts, combined with a life-long study and practice, and constant intercourse with men famous in our art, pre-eminently qualify him to hold the torch to others.

The Swiss and French trade has gathered immense advantages from the labours and experiences of Mons. Saunier, and his services have been gratefully acknowledged in those countries. The English trade is, therefore, under no slight obligation to Messrs. Tripplin and Rigg, who have undertaken the translation of this treatise into English, thus opening the rich store of knowledge to thousands more. Only those that have tried to render a technial work of such magnitude from one language into another know the tediousness of the task, and the many difficulties to be overcome; it needs all the encouragement which a love for the art, and the consciousness of performing a useful and honourable service, can give. Thirteen of the twenty-six parts which are to complete the work have now left the press. Part 12 brings us to the *detached escapements*, in which the English watchmakers are more particularly interested, and in Part 13 we are shown how to construct a *lever escapement*, the advantages of which will be patent to any intelligent craftsman. This is no doubt the escapment of the future, and it is to a great extent the escapement of the day, as such firms as could abandon deep-rooted prejudices and are intelligent enough to seize the spirit of the times, have already adopted its construction with decided success.

These practical instructions are preceded by sound theory, incorporating the principles that govern detached escapements, and which explains many contradictory phenomena perplexing to watchmakers. Before Mons. Saunier propounded his theory of detached escapements we had certainly numerous and valuable experimental data on the subject, and some authors have even laid down as laws certain conditions which practice had proved satisfactory, but for want of a fundamental, theoretical basis these experimental data and empirical rules are perpetually in contradiction, and even at the present day give rise to useless controversies. In this treatise, the experimental facts, which in the workshop are regarded as laws, are demonstrated, corrected, and supplemented. The author very truly says:—"It is not by the mere imitation of satisfactory originals, but by a thorough knowledge of the laws of motion, by calculation and exhaustive study of the theory of escapements, that we can hope to secure the best results—namely, a rate that is very good in the present and reliable in the future."

Mons. Saunier's "Traité d'Horlogerie Moderne" is also being translated into the German language by another eminent horologist, Mr. M. Grossmann, of Glashuette, Saxony, to whom we are indebted for the essay on the "Lever Escapement," and which obtained the prize of our Horological Institute. When we consider that Mr. Grossmann is the head of a large watch factory, the chief magistrate of the town of Glashuette, and a constant contributor to German and other horological periodicals, we cannot but admire his courage and devotedness in burdening himself with another and by no means easy task. But Mr. Grossmann, like Mons. Saunier, loves his calling, and no amount of toil can discourage him if he sees an opportunity for elevating the art which is so dear to him. He was well aware of the beneficial results which the watchmaking industry of his country would derive from such a valuable text-book, and unable to find any one willing and capable of doing justice to the work, he undertook it himself, in spite of his already heavily-weighing engagements.

It is almost superfluous to add that what tends to raise the standard of watchmakers in France, Germany and Switzerland, must have the same effect on our own, and we cannot too earnestly impress upon the minds of our apprentices and assistants to make good use of the means thus fortunately brought within their reach. If they mean to give an account of themselves in this age of competition, they must develop all their intellectual faculties, and their heart and soul must be in their calling. Horology offers an honourable and rich field to the highest genius.

Colorado Agates occur in large patches, scattered over the surface in chips and large fragments, and occurring also in massive ledges. Only a very small percentage of them however contain the curious and delicate crystallization of iron known as moss. The great agate field is south of the Grand and west of Williams River on a high sage plain. It is six or eight miles in length, and nearly as great in width, though agates are not found all over this area.

THE

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PATENTS.

Applications for Letters Patent.

280. William Gardner, the younger, of Pendlebury, near Manchester, in the county of Lancaster, Watchmaker, and William Miles, of Birmingham, in the county of Warwick, Jeweller, for an invention of "Improvements in watches."—Dated 23rd January, 1879.

283. Louis Desire Bodin, of Boulevard Saint Denis, 1, at Paris, for an invention of "An improvement in the manufacture of jewellery and ornaments in enamel and jet on all metals."—Dated 23rd January, 1879.

284. William Holland, of Old Chester Road, Rock Ferry, in the county of Chester, Watch Manufacturer, for an invention of "Improvements in and applicable to watches."—Dated 23rd January, 1878.

Patents Sealed.

2924. Thomas Mills, of Oldham, in the county of Lancaster, for an invention of "Improvements in watches."—Dated 23rd July, 1879.

3091. William Robert Lake, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, for an invention of "Improvements in watches and other timekeepers."—A communication to him from abroad by Victorien Bousset, of Morez-du-Jura, Jura, France.—Dated 3rd August, 1878.

3132. Frank Walter Hayward, of the city of Norwich, Chronometer and Watchmaker, for an invention of "Improvements in watches or pocket timekeepers."—Dated 8th August, 1878.

Notices to Proceed.

3766. Martin Lowenstein, of Birmingham, in the county of Warwick, Manufacturing Jeweller, has given notice in respect of the invention of "Improvements in buttons, solitaires, sleeve-links, studs, and other dress fastenings and ornaments."

3601. James Witherspoon, of Fox Court, Brook Street, Holborn, in the county of Middlesex, has given notice in respect of the invention of "Improvements in the cases or frames of barometers."

5072. Francis Joseph Perkins, of Frome, in the county of Somerset, Watchmaker, has given notice in respect of the invention of "Improvements in regulators for watches, portable clocks, and other time-pieces."

3713. John David Adams, of Marlbrough Works, 41 and 42, Marshall Street, in the county of Middlesex, has given notice in respect of the invention of "Improvements in galvanic batteries."—A communication to him from abroad by Alfred Niaudet, Rue de Seine, Paris, in the republic of France.

3842. Henry Bernoulli Barlow, of Manchester, in the county of Lancaster, Patent Agent, has given notice in respect of the invention of "Improvements in bronzing or decorating wood, porcelain, glass, metal, and other materials."—A communication to him from abroad by Professor Rudolph Boettger, Doctor of Philosophy, of Frankfort-on-the-Main, Germany.

Patents which have become Void.

4498. Juan Nepomuceno Adorno, of Harley Street, Cavendish Square, in the county of Middlesex, Gentleman, for an invention of "Improvements in watches and clocks."—Dated 24th December, 1875.

Grants of Provisional Protection for Six Months.

5072. To Francis Joseph Perkins, of Frome, in the county of Somerset, Watchmaker, for the invention of "Improvements in regulators for watches, portable clocks, and other time-pieces."

5108. To Gerard Wenzeslaus von Nawrocki, of the firm of J. Brandt and G. W. von Nawrocki, Patent Agents, of 124, Leipzigerstrasse, Berlin, in the empire of Germany, for the invention of "Improvements in studs or fasteners."—A communication from Eduard Weiler, of Berlin, in the empire of Germany.

5136. To Benjamin Joseph Barnard Mills, of the firm of Harris and Mills, of 23, Southampton Buildings, in the county of Middlesex, Patent Agent, for the invention of "Improvements in or additions to chronometrical apparatus, especially watches for the pocket, whereby the same are rendered capable of transmitting electrical signals."—A communication to him from abroad by Ernest Ganelli and Felix Bardelli, both residing at Turin, in the kingdom of Italy.

Patents Granted in British Colonies and Dependencies.

CANADA.

8353. W. A. Cates, of Union, Oregon, U.S.A., for "A geographical clock."—Dated 26th January, 1878.

UNITED STATES OF AMERICA.

209,869. Henry J. Davies and Walter D. Davies, of Brooklyn, N.Y., for "Clock-dials."—Application filed 4th June, 1878.

209,847. Frederick Young and Edwd. C. Keer, of Newark, N.J., for "Spring-bracelets."—Application filed 28th September, 1878.

209,848. Ernst H. Zoepfel, of New York, N.Y., for "Jewel-boxes."—Application filed 4th April, 1878.

210,012. Augustus Conradt, of Middletown, Conn., assignor to the Middletown Plate Company, of the same place, for "Jewel-caskets."—Application filed 12th October, 1878.

210,096. Benjamin S. Church, of Scarborough, N.Y., for "Pedometers."—Application filed 24th September, 1878.

210,119. Louis Heckmann, of Wrentham, Mass., assignor of two-thirds of his right to William H. Wade and Edward P. Davis, of the same place, for "Bracelets."—Application filed 21st October, 1878.

210,133. George Lund, of London, England, assignor to John A. Lund, of the same place, for "Electric-clock regulators"—Application filed 22nd July, 1878.—Patented in England, 15th July, 1877.

Patents Granted in Foreign States.

German Empire.

3952. J. Faulhaber, of Wehingen, for "A stand for pendulum-clocks."—Dated 20th March, 1878.—Class 83.

4276. K. Flugel, of Wächtersbach (Cassel), for "A construction of clocks."—Dated 1st August, 1878.—Class 83.

4324. Dr. M. Hipp, of Neuchatel, for "Electric Clocks."—Dated 29th April, 1878.—Class 83.

4328. The Watch Manufacturing Company of Lenzkirch (Baden), for "A construction of clock-work."—Dated 21st May, 1878.—Class 83.

France.

125,160. Grosclaude, for "A silent click and spring-work."
125,241. Miss Gontard, for "A remontoir watch."
125,328. Anquetin, of Paris, for "A remontoir watch."
125,343. Guiblet, for "A detent escapement for sea-chronometers."
125,139. De Querhöent, for "A telemeter."
125,211. Tremeschini and Clerget, Soyer and Co., for "Transmission for thermometric indicators, &c. at a distance."
125,224. Chemery, for "Telescope opera-glasses."
125,203. Marguet, of Paris, for "A dial curvimeter."
125,319. Funk, of Paris, for "A helicometer applicable as a universal clock."
110,762. Couvreux, for "A decimal chronometer."
119,252. Ferrier, for "A watch with a chatelaine remontoir."
122,987. Nemitz, for "A magical luminous dial."
125,439. Guillemin, for "A white alloy of nickel."
125,460. Beccarelli, for "Improvements in clock-work."
125,500. Baron, of Montpellier, for "Click and spring work for pendulum-clocks."
125,516. Niaudet, of Paris, for "A chloride of lime battery."

ITALY.

16. I. Sommaruga, of Milan, for "Improvements in clock-work."
104. P. A. Baron, of Paris, for "A necklace-bracelet for various purposes."
128. W. S. Wilson, of Sunderland (England), for "A galvanic battery."

BELGIUM.

46,732. A. Lion, for "Manufacturing jewellery, such as bracelets, necklaces, &c."—French Patent, 12th July, 1878.

46,798. E. Ganelli and F. Bardelli, for "Applying an apparatus for electric transmission in chronometric machines, and especially in watches."

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Bond, Eyton, trdg. as E. Bond & Co., Sand Street, Birmingham, and Frederick Road, Edgbaston, jeweller. Dec. 20. T. E. Spencer, sol., 14, Bennett's-hill, Birmingham.

Klaber, Herrman, 29, Buckingham Palace Road, and Lindor Road, Clapham, dealer in electro plate, jeweller, and agent. Dec. 21. A. Leslie, sol., 34, Conduit Street, Bond Street.

Burrows, Hny., Stockport Road, Manchester, jeweller. Jan. 4. J. H. Tattersall, sol., Blackburn.

Bloom, Harris, Temple Street, Wolverhampton, jeweller, &c. Jan. 2. R. R. Rhodes, sol., Wolverhampton.

Atkinson, Jno., Tyne Street, North Shields, jeweller. Dec. 30. Reed & Jolliffe, sols., North Shields.

Hawkins, Edward, 28, Gough Street, Limehouse, late Coventry, watch manufacturer. Jan. 4. G. Lockyer, sol., 1, Gresham Buildings.

Hirschfield, Tobias, River Street, Clerkenwell, jeweller. Jan. 1. L. Barnett, sol., 6, Palmerston Buildings, Old Broad Street.

Truscott, Wm. H., Terrace Road, Aberystwith, jeweller. Jan. 1. J. W. Ravenhill, sol., Aberystwith.

Cooper, Stephen Oswald, 88, St. Oswald's Grove, Rochdale Road, Manchester, jeweller. Jan. 6. J. A. F. Eltoft, sol., 36, King Street, Manchester.

Lloyd, Robt. Ellis, Dolgelly, watchmaker and optician. Jan. 7. W. R. Davies, sol., Dolgelly.

Rothschild, Moss Joseph, Caroline Street, Birmingham, watch manufacturer. Jan. 10. Hodgson & Haigh, sols., Waterloo Street, Birmingham.

Schuler, Isidor, trdg. as Schuler & Co., 34, Hatton Garden, and Somerleyton Road, Camberwell, jeweller. Jan. 9. Pritchard, Englefield & Co., sols., Painters' Hall, Little Trinity Lane.

Toplis, Harold, 18, Remington Street, City Road, late Myddleton Place, St. John's Street Road, clock maker. Jan. 6. J. B. Fenton, sol., Highgate.

Jackson, Jsph. Hood, Fenton and Stoke-upon-Trent, watchmaker, late High Street, Longton. Jan. 15. E. W. Hollingshead, sol., Tunstall.

Rosenbaum, Hny., Albion Square, Dalston, late Chiswell Street, Finsbury, jeweller. Jan. 11. At Goldberg and Langdon's, sols., 1, West Street, Finsbury Circus, Feb. 6 at 3.

Luntz, Marcus, Wolverhampton, jeweller. Jan. 23. At U. Stratton's, sol., Wolverhampton, Feb. 7 at 11.

Glen, Daniel, 56, Dean Street, Soho, jewellers' glass cutter. Jan. 20. M. H. Lewis, sol., 2, Weymouth Street, Portland Place.

Dividends.

Michael, Jas. (Bkt.), Rattray Road, Brixton, jewellers' factor. 1st div. 7d.; L. J. Sharp, 47, Ann Street, Birmingham.

Coe, Wm. J. (Liq.) Old Bond Street, jeweller. 2nd div. 1s.; any Tuesday or Wednesday, between 11 and 2; J. G. Bennett, at W. Stollard's, sol., South Molton Street.

Chambers, Geo., tdg. as W. Chambers & Son (Bkt.), Powell Street East, St. Luke's, watchmaker. 2nd and final div. 2s. 7d.; any Monday: J. J. Saffery, 14, Old Jewry Chambers.

Chinn, Edwd. Wm. (Bkt.), Huddersfield, jeweller. 1st and final div. 3d.; E. Carter, Nelson Chambers, Huddersfield.

Trustees Appointed.

Gardner, Wm. (Liq.), St. Mary's Gate, Manchester, watch maker. Trs., H. Vaughan, Princess Street, Manchester, accnt.; and T. R. Russell, Liverpool, jeweller.

Walton, Percy (Liq.), Brighton, jeweller. Tr., W. C. Harvey, 1, Gresham Buildings, London, accountant.

Atkinson, John (Liq.), North Shields, jeweller. Tr., F. C. Hibberd, North Shields, accountant.

Altman, Hny. J., trdg. as J. G. Joseph & Co. (Bkt.), 48, Frederick Street, Birmingham, and Toronto, Canada, jeweller and merchant. Trs., C. Baker and A. H. Gibson, Waterloo Street, Birmingham, accountants.

Whittaker, Thomas (Liq.), Oldham, watchmaker. Tr., J. Marchanton, 63, King Street, Manchester, accountant.

Meetings.

Altman, Henry J., trading as J. G. Joseph & Co. (Bkt.), Frederick Street, Birmingham, jeweller. At C. C. Birmingham, Feb. 7, at 10 exam.

QUERIES AND ANSWERS.

S. B.—Would any of your readers kindly inform me how to colour gold?

A. F. (Bristol).—The books you mention are very good, but more suitable for scientific experimenters than working silversmiths. We think that the lately-published "Silversmith's Handbook," by G. E. Gee, who is also the author of "The Practical Gold Worker," will better meet your requirements. We can fully recommend both these works.

E.G.P., A.—Will any of your many readers in the trade tell me what they do with their "Repairs not called for?" I have now by me from three to four hundred articles—some very valuable—that have been left with me for repairs, never called for again. Can we dispose of them legally, or are we bound to find warehouse-room for them year after year?

R. (Edinburgh).—We are much obliged for suggestion, and you will see that we have already made use of it. We have often stated before, that we are quite ready to afford the trade any facilities and assistance in our power, and if subscribers will only take the trouble to ask for the information they individually seek, it will considerably help us in the choice of the most suitable subjects to be treated, and we shall spare no pains in satisfying them. We are naturally desirous of rendering the journal as useful as possible to the trades we have the honour to represent, and any hints tending to further our endeavours will be most gratefully received.—You are, however, too hard on theory, and we think that you must have formed your opinion from some very hazy treatises, which no doubt abound in our horological literature. Although we quite think with you that the trade requires *practical* information, fit for immediate application in the workshop, and that disquisitions and squabbles on theoretical points are of no use to the trade at large, we cannot agree to your sweeping condemnation of theoretical instruction. When we speak of theorizing we do not mean wild speculations which sometimes produce compensation balances that only answer in the inventor's brain, but sober reasoning based on the immutable laws and principles of physics, mechanics, chemistry, etc., and we assert that a workman endowed with this capacity will make a more intelligent and successful craftsman than the one who never reasons but simply imitates. Any intelligent workman should be able to explain the "why" of all the operations he performs, and this he will never be able to do unless he is acquainted with the laws that govern them. "I proceed in this manner because that is the way it was shown to me" is a very poor answer, and will not do for the inquiring age we live in.—*Ed.*

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WATCH CONTROVERSY.

THE report of Mons. Favre-Perret, Swiss Commissioner at the Philadelphia Exhibition, has given rise to much talking and writing, which, we regret to say, has not always been in the same impartial spirit which characterized Mons. Favre's utterances. Impressed with the advantages of the American system of watch-manufacture, and the excellency of its productions, he saw that the manufacturers of his own country were likely to be losers at the game of competition with these rivals, unless they roused themselves to fresh efforts and altered their modes of manufacture. Mons. Favre, who had the interests of his country at heart, did not shut his eyes to unpleasant facts, but undertook the ungrateful task of imparting them to those interested in the prosperity of the Swiss watch-trade; and, as might have been expected, his well-meant warning did not meet with everybody's approval, and he came in for a good share of abuse.

We do not intend to post ourselves as champion of either Swiss or American watches, and we should not even have alluded again to this controversy, were it not for misstatements which have also found their way into the English press. As regards the dispute itself we can only say, "let the fittest survive." That competitors should use all the means at command for securing their supremacy is natural and fair enough, but when falsehood is intentionally resorted to for the purpose, the legitimacy of the struggle ceases, and common justice demands the immediate exposure of such false assertions.

A member of the New York Watch Importers' Association secured the insertion of a letter in the New York *Tribune*, containing some disparaging statements in reference to American watches, statements entirely at variance with facts, and emphatically contradicted by some of the leading members of the trade, including the well-known firm, Tiffany & Co., of Geneva, Paris, and New York. The object of this correspondence is evident from the source whence it originated. This letter was translated without delay, and made the rounds of the German and Swiss trade journals; but the worst of it is the "correspondence" was given out as a "leader," and the words of the Swiss watch importer were put into the mouth of the editor of the New York *Tribune*, and were stated to be the "American's own opinion of American watches." Further comment is unnecessary.

Messrs. Robbins and Appleton, as the most likely to suffer from such false reports, quite properly called the "*Tribune's*" attention to the matter, and we have much pleasure in appending the correspondence on the subject which appeared, with the editor's opinion, in the New York *Tribune*.

Extract from the New York *Tribune*, January 1st, 1879:—

To the Editor of *The Tribune*.

Sir—Our London agent writes us that matter similar to and in many cases identical with the enclosed is printed all over England and the Continent. The outrage consists in representing *The Tribune* as our censor and critic, when it was nothing of the sort. The article in question was nothing but a communication to *The Tribune* on the part of the Watch Importers' Association of New York.

Can nothing be done by you to set us right by some short article that we can publish wherever the enclosed has been published? Respectfully yours,

New York, Dec. 30, 1878. Robbins & Appleton.

[The publication which Messrs. Robbins & Appleton enclose with the above is an undoubted outrage, and can hardly have been made without dishonest intent. It quotes as the utterance of *The Tribune* what was given in *The Tribune* solely as an interview with certain persons interested in the importation of watches, and it wholly ignores the fact that this was immediately followed by counter-statements in similar interviews with those on the other side. The presumption is certainly against any who find it necessary to stimulate trade by a device so dishonest as this.—*Ed.*]

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HOROLOGY.

(Continued from page 101.)

XXXIX.—Adjustments to Positions, Isochronism and Compensation.

In reasoning upon these subjects, we do not propose to present anything original or new, but shall simply endeavour to investigate the principles involved, and to copy and translate from the writings of eminent horologists such data as will contribute to make the subjects clear and intelligible to the minds of those interested in them. There is nothing so necessary to the successful accomplishment of so tedious a work as the adjustment to position, as logical reasoning. Practical horology is nothing less than a physico-mathematical science, and it becomes necessary for the workman to educate himself to the use of these sciences, if he does not wish to waste much time and talent. Although, theoretically, the isochronism of a spring can be found without the application of an escapement, yet in practice this would hardly ever be done; it is much more likely that that adjustment is undertaken only with a watch in a finished state, and when every other part has been carefully brought to as near perfection as possible. The best writers, too, concur in the opinion, that, although by the application of an isochronal hair-spring to the balance, any irregularities resulting from unequal friction in different positions could theoretically be entirely overcome, it is nevertheless of the greatest importance that those irregularities should first be removed as nearly as possible by a judicious adjustment to positions. If a lever watch is to be adjusted to positions, one of the first conditions necessary is, that the fork and lever, as well as the escape wheel be perfectly poised. On this point the opinions of all the best writers and most experienced artisans agree; and in fact in the best movements this condition is fulfilled; but since there is such a great number of watches wanting this condition, and some of them the productions of highly reputable manufacturers, let us investigate the matter a little closer. For this purpose we beg leave to draw the attention of the reader for a moment to the principles of the mechanical lever.

The simplest form of a lever is a straight rod, supposed to be inflexible and without weight, resting on a fixed point somewhere in its length, about which it can freely turn, and having two forces applied, one on each of the extremities of the rod. The fixed point on which it rests, and about which it can turn, is called the *fulcrum*; one of the forces applied to it is called the *power*, and the other the *weight*. The distances of the points of application of the power and weight from the fulcrum are called the *arms* of the lever. If now, we imagine such a lever in the shape of a beam thirteen feet long, and the fulcrum be a foot from one end, an ounce placed on the long arm will balance a pound (*troy weight*) on the short arm; and the least additional weight, or the slightest push or pressure on the long arm thus loaded, will make the pound on the short arm move upwards. If, instead of a pound, we place upon the short arm of this lever the long arm of a second lever, whose fulcrum is one foot from its short end, and then place the short arm of this second lever upon the long arm of a third lever, supported by a fulcrum one foot from its end, and each of the three levers is thirteen feet long, then an ounce on the first lever's long arm will balance a weight of one hundred and forty-four pounds on the third lever's short arm. Now, let us apply the principle to the train of a watch, each of the wheels and pinions of which are nothing more nor less than such levers, the pivots being the fulcrums, the radii of the pinions the short arms, and the radii of the wheels the long arms, and let us suppose the leverage power of each at equilibrium to be as 1 to 8, and furthermore that the force of the main-spring acting upon the short arm of the first lever (centre-wheel pinion) is as the weight of one pound, then $\frac{1}{8}$ of a pound will balance it at the circumference of the centre-wheel, $\frac{1}{64}$ at the circumference of the third wheel, $\frac{1}{512}$ at the circumference of the fourth wheel, and $\frac{1}{4096}$ or one grain and $\frac{13}{32}$ of a grain at the circumference of the escape wheels. If now, the lever, together with the fork, should weigh three grains, and this weight be distributed so that two grains should be on one side of its axis, and one on the other, it will be apparent that, while the unequal poise could not arrest the motive power, owing to the freedom of the lever on its axis, and the great purchase which it has upon the pallet arms, it would at least occasion very great irregularity in the transmission of it to the balance—in many cases endangering the lockings—and never could such a watch run in all positions alike. One of the consequences of unequal poise in the lever is, that the watch, though the hair-spring may be properly fastened, will always sound as if it were out of beat. We may, by reasoning in this way, not only be able to appreciate the evil consequences of unequal poise in the lever, but also the importance of making them as light as a certain solidity will permit.

But we will suppose a watch perfect in this particular, and proceed to investigate the means of adjusting it to position. So far as we know, two theories have been advanced on this subject; the one resting upon the principle of governing the motion of the balance by means of the screws applied as compensating weights, the other upon that of equal friction in all positions. According to the former theory the balance is actually thrown out of poise in this way; when the watch goes fast in a hanging position, one or more of the screws of the balance which are on the top of it, when it is in equilibrium and the watch is in a hanging position, is moved a little further out from the centre, which will cause the balance to describe greater arcs of vibrations in that position and consequently make it go slower. Now it is evident that the advocates of this theory do not suppose an isochronal hair-spring to be in such a watch, and if that is the case the effect of such an operation might be a contrary one, for it might just as well happen that an increase of motion would make it go faster. Would the fact of its going faster in a hanging position indicate less friction? and even were this operation to have the desired effect in that position, how would it be if the watch were reversed? At least the practice is a violation of the law of the compensation balance—the perfect equipoise—which is most strongly inculcated, to advocate which no good workman should be guilty of doing. We propose to adjust a watch to position according to principles which shall be independent of, and not interfere with or destroy any other adjustment in the watch; and that we deem can only be done according to the principles of equal friction.

We know of no better way of adjusting a watch to position than by the pivots of the balance. J. H. Martens gives the following rules for this adjustment.

"1st. The pivots of the balance must have the least possible diameter which the weight and size of the balance will permit, must be well hardened and polished so as to cause the least possible friction in the jewel holes.

"2nd. Jewels with olive-shaped holes must be used for the balance, in which the friction is much smaller than in cylindrical ones.

"3rd. The ends of the pivots must be made almost entirely flat, by means of which the friction in a horizontal position of the watch can be made equal to that in a vertical position.

"4th. It is necessary that the utmost care be had in fastening the hair-spring to a proper height from the balance, and its coils regularly concentric to its axis, in order to insure perfect freedom in its vibration."

If these four conditions be carefully observed, we will endeavour to show that the adjustment can be accomplished by varying the third.

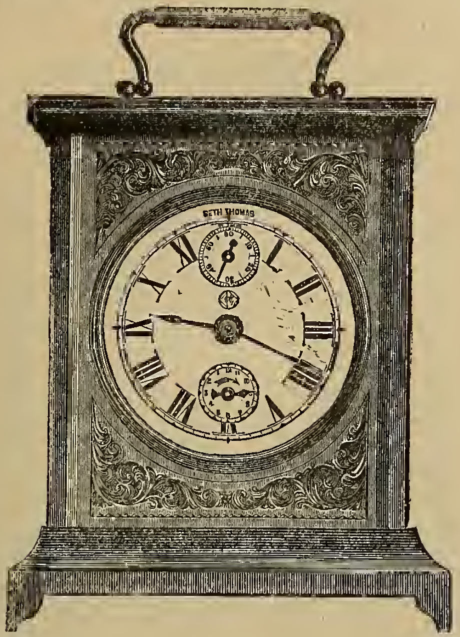
This theory rests upon producing equal friction in all positions. If, then, we present equal surfaces of the pivots to friction, the object must be attained. The end of the pivot being flat, to know the area of surface it presents to friction, we must measure its diameter and multiply it by 3·14, and we shall have the circumference of the pivot, which is also the circumference of the circle of the flat surface of the pivot, the area of which we wish to know. Now, the area of a circle is equal to the circumference, multiplied by half its radius; and if we measure half the radius of the pivot in its length, it is evident that we have, in the circumference of the pivot, the same square area as on the flat end (if the pivots are conical, full or more than twice this length on each must be perfectly cylindrical); this would present an equal surface to friction, as well on the side of the pivot as on the end of it; but when the watch runs in a horizontal position—that is, on the end of the pivot—the flat surface of the pivot rubs against an equal flat surface on the end stone; whereas, when it runs in a vertical one—that is, on the side of the pivot—the same surface, owing to the shape of the pivot hole, only rubs against a single point, and though this is in a measure balanced by two such surfaces, one on each pivot, rubbing thus against points, nevertheless the friction in that position of the watch will be much less than on the end of the pivot, whereby the arcs of vibrations of the balance will be increased. Now before attempting to equalize the friction, the balance must be perfectly poised; and to test whether this condition is entirely established in it, it should be laid with its pivots on two upright steels, brought to a knife edge, perfectly level and polished on top; on such an apparatus, if a perfect equilibrium is not established in the balance, it will show itself—there being no friction in the rolling of the pivots on these edges—and must be corrected. All the preceding conditions being complied with, and the watch is running, observe the arcs of vibration in both horizontal and vertical positions. If they are greater in the vertical position, it indicates less friction, and this cannot well be increased in that position, or we do not wish to increase it; we therefore decrease it in the horizontal position by rounding off the ends of the pivots a little; each pivot must thus be separately adjusted, until in all positions the arcs of vibration are the same, which will indicate equal friction in all. It will be seen that we may thus approximate isochronism, even without establishing it in the hair-spring, and experience has amply proved to us that a watch adjusted thus will, except under irregular external influences, run in all positions very nearly alike.

In the next number we propose giving a translation of Professor Phillips' theory of the terminal curves necessary to establish isochronism.

(*To be continued.*)

NEW CARRIAGE CLOCK.

THERE are no doubt but few in the trade unacquainted with the productions of the Seth Thomas Clock Company; and who does not know that neat and cheap little time-piece, the "Nutmeg Lever," which has had such an unprecedented sale since its introduction? We have just seen another novelty of this firm which we feel sure will meet with the same success. (The following cut illustrates the general appearance of this new article.)



It is a new carriage clock with alarm, 7 inches high, in nickel silver case; crystal sides, front beautifully gilt, and gilt handle. It has one of the firm's best lever movements, runs 30 hours, and winds and sets everything at the back. The outward appearance of this time-piece is most elegant, and appeals to the eye at once. The price in comparison with the superior movement, case, and finish is exceedingly low, and the trade will no doubt find this a desirable addition to their stock. The Seth Thomas Clock Company will shortly manufacture this clock as a time-piece only without alarm, and also as a 30 hour striking clock. The sole agent for this company is Mr. R. M. Marples, 16, Worship Street, London, E.C.

ARTISTIC JEWELLERY.

WE have already observed that the manufacturers of our high-class jewellery have spared no efforts in meeting the demands which a highly refined society makes upon their artistic taste and manipulative skill; and that their success has been beyond expectation. The beauties who adorn our drawing-rooms have now no need to go across the channel for ornaments to enhance their natural charms. We should recommend them to pay a visit to Messrs. J. R. Williams and Son, of 108, Hatton Garden, so justly celebrated for their exquisite designs in diamond work, gem rings, civic jewellery, &c., and we are convinced that even the most cultivated taste can be gratified in their establishment. The pleasure has been afforded us to view some of the latest creations of the above-mentioned goldsmiths, and we are glad to be able to say that they even surpass their previous efforts, which have earned them the rank they hold among art-jewellers. Among the leading novelties are elaborate ornaments in the shape of wreaths for the neck, also adaptable as trimmings in black velvet. A most elegant pattern is a diamond wreath 8 inches long, by ¾ wide, to be worn either in the hair or on the neck, and is particularly suitable as decoration for ball dress. Another splendid design is an ornament adapted as a brooch to carry a brilliant pendant, which ornament can also be worn on velvet. It consists of two magnificent diamond sprays, united by a cluster of brilliants; the latter is connected by a small diamond chain with two more diamond sprays held by a circle of brilliants, to which the pendant can be attached. It is altogether one of the handsomest ornaments we have seen, and would be a credit even to such eminent Parisian jewellers as Boucheron, or Massin. It would require more space than we can dispose of to give an adequate idea of the high style of work produced in this establishment, but we should advise those of our readers who have any special order for a bridal or presentation gift to communicate with Messrs. Williams and Son, as their great experience enables them to offer most valuable advice and assistance.

FORGING, HARDENING, & TEMPERING TOOLS

(*Concluded from page* 101.)

HOLLOW cutters often crack in hardening, and this difficulty generally arises from the difference between the amounts of contraction of the inner and outer circumference. They should be hardened in oil, and an experienced workman says he has no trouble with them when he dips them horizontally, gripping the open ends by the tongs. This seems to retain a portion of the oil within during the process of hardening, and, becoming heated, prevents the cooling of the interior shell too quickly, thus giving time for the particles to arrange without undue stress. Tools should never be heated so hot as to cause scale, and as far as possible the steel should be heated a uniform temperature all over.

The best tool is that which will do the largest amount of work in a given time without resharpening. It follows, therefore, that the harder the tool can be made to stand, the longer it will keep its cutting edge. The form of the tool and its relative position to the work has great influence upon its staying qualities.

The shape and proportions of a tool have almost as much to do in determining the degree of hardness to be imparted to it as the work it will have to do. Small and thin tools should, as a rule, be lowered in temper to a light or dark straw colour, but chisels are usually drawn down to a blue colour. It has been stated above that a tool requiring frequent grinding should be so tempered that it may be ground several times without grinding off the temper required for the work. It is best, therefore, to harden the tool outright, and gradually draw down the temper to the required degree by holding the tool over a piece of hot iron, turning it about freqently in order that the temper may be uniform. Taps and reamers are best drawn inside some hollow article made hot, such as an old pinion or piece of tube. There should be plenty of room inside, so that the tap may not touch the side, and the tool should be frequently turned to ensure uniform heating. Dies may be placed upon a piece of flat iron made moderately hot, and turned upon all sides frequently. As soon as the desired colour is shown, the article should be immersed in water or oil, as the case may be, care being taken to avoid warping, as before stated. It is sometimes necessary to lower the temper of tools slightly, which would otherwise stand as hard as the steel could be made, because of overheating; but of course, if the steel be burnt—that is, brought to a white heat—it is useless, and must be cut off. Where it is possible, it is always best to sharpen tools after hardening, for it not only puts on a keener edge, but the skin produced by forging renders the tool tougher than if it had been filed up previous to hardening. The slower the temper is drawn the more even it will be.

In order to give taps and other tools of a similar nature a certain and uniform colour, resort is had to hardening in sand, kept over a fire in an iron box. The sand should be well stirred before putting in the tool, otherwise the heat will not be uniform throughout. The tool should be kept covered as much as possible, and occasionally turned, exposing only sufficient to watch the colour.

JEWELLERY.

BY GEORGE WALLIS.

(*Continued from page* 88.)

JEWELLERY, at least in its modern treatment, may be divided into three generic sections :

1st.—That in which the stones or gems are the leading features, constituting in their arrangement the design, and completing, by the effect obtained in the setting, the purpose of the jewel. The metal, gold or otherwise, is used simply as the mechanical means of fixing and arranging the gems; being practically unseen except as a means of holding the object together as a decoration for the person.

2nd.—That in which the gems and gold, in combination with enamel, or engraving, or both, go to make up the design by an artistic distribution of the materials in the construction of the jewel as a whole.

3rd.—That in which gold or metal alone is used, and in which the whole design is wrought and embellished by engraving and chasing, or worked perfectly plain so far as surface is concerned, the display of the metal itself being the leading feature of the design.

The modes of production have been already named as partaking of two distinct features, hand-work and machinery. But a third has to be recognised, and this is the combination of hand-work and mechanically produced details.

The hand-work method is the most ancient, the most legitimate, the most artistic, and, as a matter of course, the most costly; yet there are few art-industries in which the skilled worker can be said to require fewer appliances for the prosecution of his handicraft.

In Oriental countries to this day, the travelling jeweller is not unlike the travelling tinker of our own country. He carries with him all the means of executing the ornaments that he may be commissioned to make. The gold for the purposes of this work is given to him by his employer, and he squats down in some convenient position, within or outside the residence of his patron, and hammers, cuts, drills, shapes out and puts together after a somewhat rude fashion, but with an unerring instinct, ornaments which, in point of fitness to the purposes for which they are intended, and harmony of effect as regards the combination of form and colour, the Western imitator fails to approach, in spite of all the mechanical skill and scientific appliances made ready to the hand.

The Oriental worker takes the minimum of gold and other materials, and out of these he gets the maximum of effect, without any special efforts to do more than give each portion of metal, each stone, and each touch of enamel, its proper position and value. He never commits the vulgarism of making a great display of gold surface, for the purpose of suggesting a bullion value which does not exist. Whatever the materials may be, rich and rare, simple or common, he makes the best of them in their integrity, from gold and gems of the purest quality and most perfect character to the primitive imitations in glass and paste, or bits of metal foil or wood. Thus each material stands for exactly what it is, neither more or less.

The tools and appliances necessary for a working jeweller to start in business on his own account are comparatively few, and a few pounds enable him to secure every requisite for carrying on the production of jewellery by hand. A peculiarly shaped work bench, a jet of gas, or the flame of a candle or lamp, some solder, and the inevitable blowpipe, with a vice, hammer, shears, files, punches, and drills, may be said to pretty nearly represent the plant. A few old coins, or for want of them some new ones, a few ounces of silver and zinc, and your working jeweller can commence his business, if he has skill, ingenuity, and a fair share of artistic taste. These simple elements have been the beginning of many highly successful men and important establishments.

This will account for the extent to which the working jewellers of Birmingham have spread themselves, erecting their own little workshops near to their dwelling houses, and carry on business after a very independent and certainly respectable fashion. In Clerkenwell the same thing occurs, but in a different way, because under less favourable local circumstances and social aspects.

As a matter of course the successful workers and their descendants have become capitalists, establishing manufactories in which, although the same division of labour exists, in relation to the special articles of jewellery to which individual workmen direct their attention, yet the whole is under a general supervision and direction. Admirably arranged and well lighted and ventilated workshops, however, now take the place of the little workshops in the back-yard or in the attic.

The introduction of machinery for a variety of purposes has caused a great change not only in the extent of the productions, especially at Birmingham, but in the artistic characteristics of modern manufactured jewellery.

Hand-made work of a heavy and costly character, which is now chiefly carried on in London, mostly in Clerkenwell, for the great houses at the West End which supply jewellery to the public, requires of necessity a large amount of experience, ingenuity, and skill to execute in a satisfactory manner. A design is generally made on paper, a drawing in fact representing the appearance of the article required, with sections, etc., showing the construction, in cases where any novelty in that direction is aimed at. The working jeweller, taking into consideration the exigencies of his materials, proceeds to cut and shape the thin plates of gold, which in most cases is ready rolled to a suitable thickness for this purpose. He hammers, files, and punches the various portions into the requisite forms, adapting them for soldering together, or fastening by pins and rivets as may be required. In the cases where elaborate ornamental details, the human figure, or representations of animal life are required, he beats up the plate of metal to the general contour of the ornament or figure. During this operation of beating up the gold to a given shape, the metal has to be frequently passed through the fire for the purpose of annealing, otherwise it would split or crack from becoming brittle under the hammering. Filling the inside with a mixture of pitch and brickdust, he proceeds to punch and chase the details upon the surface to be finished, in the same manner as the silversmith or goldsmith works his ornaments by the repoussé process upon the surface of a vessel formed of either of the precious metals. When complete, the pitchy substance is melted out, and the detail is ready to be soldered, or otherwise fixed in its intended position.

DESILVERING.—The following is a liquid which will dissolve silver—without attacking copper, brass, or German silver—from silvered objects, plated ware, etc. It is a mixture of one part of nitric acid with six parts sulphuric, heated in a water-bath to 160° Fahr., at which temperature it operates best.

LACQUER FOR PHILOSOPHICAL INSTRUMENTS.—Take three quarter oz. of gum guttae (or gamboge), two ozs. of gum sandarach, two ozs. of gum elemi, one oz. of dragon's-blood, one oz. of seed lac, two grs. Oriental saffron, and twenty ozs. of pure alcohol. the tincture of saffron is obtained by infusing in alcohol for twenty-four hours, or exposing to the heat of the sun in summer. The tincture must be strained through a piece of clean linen cloth, and ought to be strongly squeezed. This tincture is poured over the dragon's-blood, the gum elemi, the seed lac, and the gum guttae, all pounded.

TRADE RECIPES, &c.

(Continued from page 103.)

New and Beautiful Substitutes for Gold and Silver.—The following are some very beautiful alloys, produced by Messrs. Meiffren and Cie, of Marseilles, and applicable in the manufacture of jewellery. To make an alloy having the colour and appearance of gold, they place in a crucible copper as pure as possible, platinum and tungstic acid in the proportions below stated, and when the metals are completely melted, they stir and granulate them by running them into water containing 500 grammes of slaked lime and 500 grammes of carbonate of potash, for every cubic meter of water. This mixture, dissolved in water, has the property of rendering the alloy still purer. They then collect the granulated metal, dry it, and after having re-melted in a crucible, they add a certain quantity of fine gold in the proportions hereinafter specified. An alloy is thus produced which, when run into ingots, presents the appearance of red gold of the standard $\frac{750}{1000}$, and to which may be applied the name of *aphthite*, or unalterable. They can change the colour of the alloy by varying the proportions of the different metals. As flux they use boric acid—nitrate of soda and chloride of sodium previously melted together in equal proportions. The proportion of flux to be employed is 25 grammes per kilogramme of the alloy. The proportions they employ, by preference, for producing an alloy of red gold colour are: copper, 800 grammes; platinum, 25; tungstic acid, 10; and gold, 170 grammes.

The alloy used in imitation of silver consists of iron, 65 parts; nickel, 23 parts; tungsten, 4 parts; aluminum, 5 parts; and copper, 5 parts. The iron and tungsten are melted together and then granulated, as in the case of the previous alloy, except that in this instance the water into which the mixture is run contains one kilogramme of slaked lime, and one of carbonate of potash, per cubic meter. The nickel, copper, and aluminum, are also melted together and granulated by running into water containing the same proportions of lime and potash. Care should be taken during the melting to cover the metals contained in the two crucibles with a flux, composed of one part of boric acid to one part of nitrate of potash, or nitre. In the crucible containing the aluminum and copper they place a lump of sodium of about two grammes in weight, when treating five kilogrammes of the three metals (nickel, copper, and aluminum) together, to prevent oxidation of the aluminum, and they also add charcoal to prevent oxidation of the copper. Before granulating the metal in each crucible it should be well stirred with a fire-clay stirrer. The granulated metals are dried, as in the former case, then melted together in the same crucible, in the proportions above indicated, and well stirred, after which the alloy is run into ingots. The alloy thus obtained, to which may be given the name of *sideraphthite* (or unchangeable iron), presents the same white appearance as platinum or silver, and is not more expensive than German silver. These improved metallic alloys are capable of resisting the action of sulphuretted hydrogen, are unattacked by vegetable acids, and but slightly by mineral acids; they are also perfectly ductile and malleable.

(1 gramme = 15·4323 grains; 100 grammes = 3·527 oz.;

Dead Silvering for Medals.—The perfect smoothness which a medal generally possesses on the surface renders it very difficult to obtain a coating of dead silver upon it having the beautiful silky lustre which characterises that kind of work, except by giving it a very thick coating of silver, which takes away the sharpness of the impression. This dead appearance can be easily obtained by putting the medal, previous to silvering, in a solution of copper, and depositing upon it, by means of a weak current, a mere blush of copper, which gives the face of the medal that beautiful crystalline richness that deposited copper is known to give. The medal is then washed from the copper solution, and immediately put into the silver solution. A very slight coating of silver will suffice to give the dead frosty lustre so much admired. When large objects are required of a dead silver finish, it is obtained by having the solution in good working condition, and watching the deposit to take the article out of the solution at the proper time, before it gets the chalky appearance; and even when this has taken place, by allowing the article to remain a few minutes in the solution, without being in contact with the battery, this chalkiness will disappear. Care has to be taken that it is washed out the solution in *pure* water; if not, the surface will be stained—neither should it be touched with the fingers. James Napier.

Imitation Tortoise-shell.—Horn is used for the purpose. It is pressed into proper plates, scales, or other flat form, and the following mixture prepared: Quicklime 2 parts, and litharge 1 part; temper them together to the consistence of a soft paste, with soap lye. Put this paste over all the parts of the horn, except such as are to be left transparent in order to give the resemblance to the real tortoise-shell. The horn must remain in this manner covered with the paste till it is thoroughly dry; when, the paste being brushed off, the horn will be found partly opaque and partly transparent, in the manner of tortoise-shell, and when put over a foil of Dutch gold metal, will be scarcely distinguishable from it. It requires some degree of fancy and judgment to dispose of the paste in such a manner as to form a variety of transparent parts, of different magnitudes and figures, to look like the effect of nature; and it will be an improvement to add semi-transparent parts, which may be done by mixing whiting with some of the paste, to weaken its operation in particular places, by which spots of a reddish brown will be produced, which if properly interspersed, especially on the edges of the dark parts, will greatly increase the beauty of the work, and its similitude to real tortoise-shell.

To Clean and Polish Alabaster.—Soap well and wash with hot water. If stained, apply fuller's earth, pipe-clay, or whiting, for three or four hours, then wash off. If very dirty and stained, first wash with aquafortis diluted with water, or take ground pumice stone of the finest quality, and mix it up with verjuice, let it stand for two hours, then dip in a sponge and rub the alabaster with it; wash with a linen cloth and fresh water, and dry with clean linen rags. Any kind of marble may be done in the same way. To polish alabaster it is rubbed with finely powdered pumicestone, or dried shave-grass (equisetum) and water, and afterwards with a paste formed of finely powdered and sifted slacked lime and water. The rough polish thus produced is then brought up and finished off by friction with finely powdered talc, or French chalk, until a satiny lustre is produced.

To Clean Pearls.—Soak them in hot water in which bran has been boiled, with a little salts of tartar and alum, rubbing gently between the hands when the heat will admit of it. When the the water is cold, renew the application till any discolouration is removed; rinse in luke-warm water; lay them on white paper in a dark place to cool.

(To be continued.)

BOOK NOTICES.

Free Trade in Gold and Silver Plate and Watches. By Edward J. Watherston. Second edition. Price 6d.

Under the above heading Mr. Watherston presents in a collective form the numerous articles which have appeared in the press on the subject of Plate Duty, Hall-marking, &c. From a number of letters received we find that many of our readers are quite in a fog about this all important matter, and we should advise them to carefully peruse the above without delay. No one taking an interest in the welfare of his trade should be without a copy.

HINTS TO REPAIRERS.

(*Continued from page* 104.)

To satisfy the demands of a number of our subscribers we purpose going through the various operations of watch repairing. We do not pretend that our method is the only one, but it is the result of long practice, and has always given satisfaction. Some of our readers will probably find but little new. We do not write, however, for the favoured few, but for that large class of workmen who have not had the advantage of good instruction, to many of whom works on Horology are unknown, and who outside of actual experience look to their trade journals. No class of artisans stands more in need of a journal devoted to their special interests than watchmakers and jewellers, and every one should support it not only by subscribing for it, but by contributing to its columns such matter as may be of interest to the trade. Every good workman can certainly write something that will be of value and interest to the majority of its readers. Some are adepts at pivoting, others in jewelling, springing, etc. Now let any one who has some peculiar method of doing any particular kind of work, and knows the same to be good, give the trade the benefit of such knowledge, and we will all gain something without losing anything.

The first thing to do, when you are going to repair a watch, which we will suppose to be an English lever, is, of course, to take it out of the case, then carefully examine the balance to see if it runs true, and examine the end shake and also the side shake of the pivots; then examine the pallets, fork, and scape wheel, banking pins, and guard pin; hold the watch in the left hand and turn the balance with the left fore-finger, so as to bring the roller jewel *outside* of the fork; then, with the tweezers, held in the right hand, see if the scape-wheel teeth, when resting on the locking face of the pallets, will force the outer end of the fork (when the banking pins are near the outer end of the fork) back against the banking pins, *after* you have moved the fork so that the guard pin presses against the roller, as it not unfrequently happens that the scape-wheel teeth are slightly worn on the end, and are, consequently, too short, which will be indicated by the guard pin remaining against the roller after placing it there, and there is power enough exerted on the pallets by the scape-wheel to ordinarily drive the watch, in which event you will have to put in a larger scape-wheel. Sometimes the pallet jewels are broken, or the corners need polishing. Again, both the locking and impulse faces are cut, and need polishing, or new ones may be required. After thoroughly examining the escapement, take off the cock and remove the balance and examine the balance staff, pivots, hair-spring, and cock-jewel, roller and roller jewel, examine the hands and hour wheel and see if the latter has too much or too little shake. Now take off the dial, examine the depthing of dial wheels, see if the pin for the minute wheel is tight and the right size, and if any of the teeth in the dial wheels are bent; let down the mainspring, if the barrel arbor is long enough to allow you to hold it with a key, do so, and carefully raise the click and let the spring unwind; if not, place the pin vice on the fuzee arbor and hold it with the left hand, with lower plate up, and then remove the third bridge; take out the third wheel, and then let the spring down. Now examine all the end shakes and side shakes; take out the barrel, remove the pins, and carefully examine every jewel and hole in the watch, then examine the pinions, pivots, and wheels—all with a glass—and see if any of them are worn. If the teeth are worn in any of the wheels, either put in a new one or reverse the old one. If a pinion is much worn, the only safe way is to put in a new one. If a pivot, you must either put in a new pinion or pivot, or else *turn down* the old one and re-polish it, and, in a plain watch, bush up the hole; if a jewelled watch, put in a new jewel. You will frequently have to turn down the centre and fuzee pivots and bush the holes, as they, especially the centre holes, are so thin that they cut the pivot. In bushing the centre and fuzee holes, always leave the bush as *long* as possible.

Now, after having examined all the train, take the fuzee apart and see if it does not want a new click or ratchet, or other repairs; also examine the barrel and see if the main-spring is of the proper width, strength, and length. After taking out the main-spring, put the arbor and lid back again, and examine its shakes. If the holes are worn you must bush them, and you may have to turn the arbor pivots true also. If the barrel is "spread" it must be closed, for which purpose a valuable tool is now in the market called a "barrel-closer," one of which every watchmaker should have. Next, see if the barrel runs true on the arbor, which you can do by holding the arbor in your cutting-plyers and turning the barrel slowly, which will show you which side is too high. Correct this by spreading the lid slightly in the high side (when lid is up) and taking a little off from the other side. See if all the pillars are in fast, also dial frame feet. When taking the watch apart carefully notice all the screws, and see if any of the threads are "stripped"; if so put in new screws. Not only see if any of the jewels are broken, but see if they are loose; peg them out, and see if they are polished inside. Sometimes the balance-staff holes are too large in the hole; at others the holes are not polished, or are worn down on one side; again they are too thick, scarcely allowing the pivot to protrude, in which event the shoulder will rest in the cup and materially affect the running of the watch, if it does not cause it to stop altogether when in certain positions. Too much care and attention cannot be used in making a thorough examination of every part of the watch, before you do any work at all. When a watch is left to be "put in order," never do any work on it until you have carefully examined it in every part, and if you have agreed to repair the watch for any stipulated price, make all the repairs needed, even if the work is worth much more than you have agreed to do it for, In other words, if you agree to put the watch "in order" for a certain price, do so; on the other hand, if nothing is said about the price, and you find, after due examination, that it will cost more than you have reason to suppose that the owner would like to pay, do nothing until you can see him and explain the trouble. Many men, who would think themselves insulted if their integrity or honour were called in question, are so very *economical* that they are quite willing to take advantage of a technicality to get ten shillings' worth of work done for five, and the only sure way to avoid misunderstanding is to adhere to this rule.

The watch is now in pieces and ready for any repairs needed. We will suppose our present difficulty lies in the barrel; the main-spring broken, the barrel spread, and the holes worn too wide. Now for the remedy. In the first place, with our barrel closer or contractor, we will close or contract the barrel to its original size by placing it in one of the holes that is slightly smaller than the barrel, with the upper or open side of the barrel down, placing the disk over it, and tapping lightly the bar that is screwed into it until the barrel is reduced to the proper size. Next, bush the holes, having first cleared them out; or what is still better, cement the barrel up on a chuck in your foot-lathe, the outside against the face of the chuck; then bore out the hole and turn down the projection a little for a shoulder; then make a bush with a square shoulder, and fit it from the inside of the barrel, and the same with the lid. After riveting in these bushes put the barrel back on the chuck again, using a brass chuck, with a hole in the centre as large as the arbor pivots; true up the barrel by its periphery, then drill a hole in the centre, and bore out the hole nearly large enough to take the pivot, and turn down the shoulder to the same thickness as the old one. If the barrel does not run true, true it up with a graver, and if it will bear it, true out the groove for the lid, leaving it lightly undercut; take the barrel off, and put up the lid, and true it up by the outside, same as with the barrel; centre and drill a hole, and bore it out slightly smaller than the pivot that is to go into it; turn the shoulder back to correspond with the old one, then fit the lid to the barrel if it is too large. If too small, it should have been spread a little with a smooth-faced hammer before putting it up in the lathe. Now take it off, and with a round broach fit the arbor, always wetting the round broach when using it, as that will prevent its tearing up the brass. To avoid getting the barrel either too high or too low, it is well to bush the barrel and fit the arbor before bushing the lid, so that you may be certain to get the end shake right, and have the barrel the same height as before; then bush the lid and fit it to the barrel, and fit the arbor and get the end shake again by turning off the shoulder of the lid. Now see if not only the end shake is right, but that the barrel runs true on its arbor, if not, correct it as directed previously.

(*To be continued.*)

QUERIES AND ANSWERS.

S. B. To colour gold.—There are two processes for colouring, similar in purpose and effect; the oldest is called dry colouring, because the chemicals used are solids, namely, saltpetre, alum and salt; but acid colouring has come into more general use on account of its being easier to manage and of the wider range of qualities of gold which can be submitted to the process. The purpose is simply to remove from the surface of the gold all alloy so as to leave a coating of pure gold of rich yellow colour, which is very finely frosted, to obtain which, with perfect equality, it is necessary to have the surface smooth, then anneal and boil out in pickle made of nitric acid and water, lastly, annealing black before dipping it in the colour. A good formula for colouring mixture, saltpetre: 9 ozs. 12 dwts., salt 4 ozs. 16 dwts., muriatic acid 6½ ozs. The effect on the article is necessarily to reduce the weight, therefore the quicker it is done the better, and if the gold be properly alloyed 1½ minute is sufficient time to expose them to the action of the mixture, which must boil up till it fills a No. 10 blacklead crucible. In all acid coloured work there is between the body of gold and the outside colour, a brown coat of partially coloured material, and if the work is left too long in the mixture the coat is much thickened, and the fine colour may be easily peeled off, especially if the gold be too low in quality. The finest colour and best surface may be obtained on about 15 carat gold, but the range is from 12 to 20 carat, and to be successful the operator needs considerable practice. Before using a crucible it is necessary to have it well annealed, as accidents are thereby avoided. To prevent change in the colour of goods, after colouring, it is well to wash them in ammonia which will neutralize any salts that remain in the somewhat porous surface, and if the articles are scratch-brushed, which slightly brightens them, they are less liable to soil. It is best not to give the ammonia bath till after brushing, following with a good wash in hot water and drying in hot saw-dust.—H. G. M.

A fine gold colour on jewellery is obtained by boiling 8 ozs. saltpetre, 4 ozs. alum, and 4 ozs. common salt together in a porcelain or other fire-proof vessel (not metallic) in barely sufficient water to dissolve them; add 9 ozs. of strong muriatic acid to this solution and filter. This quantity will be sufficient for colouring 4 ozs. of work at a time, and should be kept in a well stoppered glass bottle when not in use.

Another recipe for the same purpose is: boil 10½ ozs. saltpetre and 5¾ ozs. common salt together, in a porcelain dish, in a quantity of soft water barely sufficent to dissolve them, ⅛ oz. nitrate of silver and 9½ ozs of muriatic acid; filter. This quantity will also be sufficient for 4 ozs. of work at a time, and should be kept as the previous preparation when not in use. To colour with either, anneal the work twice and boil it, each time after annealing, in a pickle consisting of 8 parts of water and 1 part sulphuric acid. Then pour a sufficient quantity of the colouring mixture in a porcelain dish, and heat it about 150° Fah. Hold the work in this for about two minutes, then take it out and rinse it in clean water. If not enough coloured to suit, the process must be repeated until the desired colour is obtained. 1 oz. nitrate of soda and ½ oz. chloride of sodium dissolved in a slight excess of warm water, with the addition of about 5 drachms hydrochloric acid make also a capital gold-colouring solution. It must be kept boiling while the work is in it.

E. G. P., A.—"Repairs not called for."—I have a placard in a prominent place in my shop, informing my customers that *repairs not called for within six months* will be sold to defray expenses. The same intimation I have printed on the receipts I give when work is left with me. If any repairs are not called for after the lapse of six months I can sell them, but I generally keep them another six months before I do so. I keep a special account of such sales as I should have to refund any surplus to the owner, should he apply for it. If you advertise the repairs of long standing, giving notice that they will be sold unless called for within a certain time, you may, after expiration of that time legally sell them. Cost of advertising to be added to repairs.—Clerkenwell.

Vortex.—The patent laws, like other laws, are left to the interpretation of professional men, and we advise you to consult a patent agent on the subject. Our own opinion is that you could not obtain a valid patent six or twelve months after the watches have been publicly sold, and that the purchaser of these watches is quite at liberty to manufacture the same article. We know that inventors will not give any particulars about their inventions before they are duly patented, and that they avoid any publicity until the necessary protection has been obtained. Send for "Patent Law Amendment Acts," together with the rules and regulations issued by the Commissioners of Patents for Inventions. They will be forwarded to you on receipt of eight stamps by the Commissioners of Patents, Sale Department, 38, Cursitor Street, Chancery Lane, E.C., or if you prefer it we shall obtain them for you on the same terms.

X. X.—New Weights and Measures Act.—The section you refer to is Sec. 24, and reads as follows:—"Every person who uses or has in his possession for use for trade a weight or measure which is not of the denomination of some Board of Trade standard, shall be liable to a fine not exceeding five pounds, or in the case of a second offence ten pounds, and the weight or measure shall be liable to be forfeited." Although the Act came in force with the 1st of January last, the use of the old weights is not finable till six months afterwards. Sec. 86 provides these six months' grace to meet the difficulty felt in getting new weights.

The steeple of Cripplegate Church contains a clock which presents one face to the east and another to the north. It was made by Lang Bradley, in the year 1722, and was thoroughly repaired in 1797, by William Dorrell, of Bridgewater Square, and made to strike the hour on the tenor bell. In 1846, it was again repaired by Thwaites and Reid, and the pendulum was lengthened. This clock is now considered to be one of the best in London. A former Alderman, Sir William Staines, among his other munificent gifts to the parish, presented a small and inharmonious bell, upon which the clock strikes a note, discordant to the peal. The chimes, which are almost without a rival, were constructed in 1792 by George Harman, of High Wycombe, Bucks, and play seven tunes, changing the tune daily at noon. They were thoroughly repaired in 1849, when the tunes were re-arranged, and those of inferior melodies taken off and others substituted.

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from page* 106).

IN the South Kensington Museum is an upright clock, the case of which is richly inlaid with marqueterie scroll-work. The dial is marked "Henry Poisson, London,". The height of the clock is eight feet three inches and a half. It is of the period of Queen Anne; and it was purchased for £12. In the same museum is a clock in the form of a globe, supported by three bronze amorini. It is of French work, about the year 1700. The height is three feet eight inches and three quarters; and the diameter two feet. It was purchased for £150. Mr. G. H. Morland has a clock mounted on a truncated column of ormolu with a globe and mathematical instruments. It is of French manufacture, and of the eighteenth century. It has been exhibited in the above-named museum. In that national collection is also a clock, the case of which is in old Florentine porcelain, surmounted by a figure of Time. The dial is surrounded by a wreath of olive leaves in ormolu. The height is two feet six inches. This clock is of the eighteenth century, and was purchased for £18. Also an old French clock, in an ormolu case, it is of the period of Louis XIV. The dial is inscribed "Thuret à Paris," The height is twenty-two inches. The clock was purchased for £15.

A correspondent of *Notes and Queries*, of September 16th, 1865, says: "Some four or five years since, on entering a loft in a coal-wharf in this town (Bodmin), my attention was drawn to an antique clock silently standing on a bracket, and begrimed with dust and dirt. It was without a case; the pendulum and weight uncovered, like a Dutch clock; the bell formed a dome above. It had the inscription 'William Allmand in Louthcberry fesitt.' The grimy tenant of the loft told me that it was the property of his employer, and that it went by the name of 'Bishop Hall's clock.' On account of its ancient look, I bought it of the owner, and received with it the following history. It was formerly in the possession of the Rev. Robert Walker, of South Winnow, in Cornwall, and was valued by its owner as 'Bishop Hall's clock.' After Mr. Walker's death, his household goods were sold, and this clock was then purchased by the coal-merchant. I subsequently found that this Mr. Walker was a descendant of Hall, the famous Bishop of Exeter, and afterwards of Norwich."

On the west side of St. John's Lane, Clerkenwell, is situated Albion Place, which was erected in 1822, on the site of an old court called St. George's Court, which was then pulled down. Here in 1721 lived Christopher Pinchbeck, the discoverer of an alloy of metals, closely resembling gold, which was named after him "Pinchbeck," and the inventor of "astronomico-musical clocks." He appears to have excelled in the construction of musical automata, which on several occasions he exhibited in a booth at Bartholomew Fair; and, in conjunction with Fawkes the conjuror, at Southwark Fair. He made a musical clock for Louis XIV., of France, which is said to have been an exquisite piece of workmanship, and worth about £1,500. He also made a fine organ for the Great Mogul, worth £300. He died on November 18th, 1732. From the following advertisement, which appeared in *Applebee's Weekly Journal*, of July 18th, 1721, it appears that Pinchbeck removed from Clerkenwell to Fleet Street, about that time:—

"Notice is hereby given to Noblemen, Gentlemen, and others, that Chr. Pinchbeck, Inventor and Maker of the famous Astronomico-Musical Clocks, is removed from St. George's Court, St. Jones's Lane, to the sign of the 'Astronomico-Musical Clock' in Fleet Street, near the 'Leg' Tavern. He maketh and selleth Watches of all sorts, and Clocks, as well for the exact Indication of Time only, as Astronomical, for shewing the various Motions and Phenomena of planets and fixed stars, solving at sight several Astronomical problems; besides all this a variety of Musical performances, and that to the greatest Nicety of Time and Tune with the usual graces; together with a wonderful imitation of several songs and Voices of an Aviary of birds, so natural that any who saw not the instrument would be persuaded that it were in reality what it only represents. He makes Musical Automata or Instruments of themselves to play exceeding well on the Flute, Flaggelet, or Organ, Setts of Country Dances, Minuets, Jiggs, and the Opera Tunes, or the most perfect imitation of the Aviary of Birds above mentioned, fit for the Diversion of those in places where a musician is not at hand. He makes also organs performing of themselves Psalm Tunes with two, three, or more voluntaries, very convenient for Churches in remote country places where Organists cannot be had, or have sufficient encouragement. And finally he mends Watches and Clocks in such sort that they will perform to an exactness which possibly thro' a defect in finishing or other accidents they formerly could not."

The following note was made by George Vertue, the celebrated engraver:—"On Thursday evening, October 4th, 1722, being in company, and some talking of curiosities in art, mentioned a fine and curious clock made by Pinchbeck, which, with a small movement or touch, could play many and various sorts of tunes, imitating many sorts of instruments, several birds, etc., the music being just, regular, and tuneable, and the time well observed." A mezzotinto portrait of Christopher Pinchbeck, by Faber, from a painting by Wood, represents him with an open watch in his hand. His portrait was also published in his shop-bill, oval, folio. His son appears to have carried on his father's business; for, in the *Daily Post* of July 9th, 1733, appeared the following advertisement:—"To prevent for the future the gross Imposition that is daily put upon the Publick, by a great Number of Shopkeepers, Hawkers, and Pedlars, in and about this Town. Notice is hereby given, That the ingenious Mr. Edward Pinchbeck, at the 'Musical Clock' in Fleet Street, does not dispose of one Grain of his curious Metal, which so nearly resembles Gold in Colour, Smell, and Ductility, to any Person whatsoever; nor are the Toys made of the said Metal sold by any one Person in England except himself; therefore Gentlemen are desired to beware of Impostors, who frequent Coffee Houses, and expose to Sale Toys pretended to be made of this Metal, which is a most notorious Imposition upon the Publick. And Gentlemen and Ladies may be accommodated by the said Mr. Pinchbeck with the following curious toys, *viz.:* Sword Hilts, Hangers, Cane Heads, Whip Handles for Hunting, Spurs, Equipages, Watch Chains, Coat Buttons, Shirt Buttons, Knives and Forks, Spoons, Salvers, Tweezers for Men and Women, Snuff Boxes, Buckles for Ladies' Breasts, Stock Buckles, Shoe Buckles, Knee Buckles, Girdle Buckles, Stock Clasps, Necklaces, Corrals. And in particular Watches, plain and chased in so curious a Manner as not to be distinguished by the nicest Eye from real Gold, and which are highly necessary for Gentlemen and Ladies when they travel; with several other fine Pieces of Workmanship of any Sort, made by the best Hands. The said Mr. Pinchbeck likewise makes Astronomical and Musical Clocks; which new invented Machines, are so artfully contrived as to perform on several Instruments great variety of fine Pieces of Musick, composed by the most celebrated Masters, with that Exactitude, and in so beautiful a Manner, that scarce any Hand can equal them. They likewise imitate the sweet Harmony of Birds to so great a Perfection as not to be distinguished from Nature itself. He also makes Repeating, and all other Sorts of Clocks and Watches; particularly Watches of a new Invention, the Mechanism of which is so simple, and the Proportion so just, that they come nearer Truth than any others yet made. He also mends all sorts of Clocks and Watches, Musical Machines, and Pieces of Machinery whatsoever, after so just a Manner that they shall go well though they never did before." At the top of this advertisement is a rude woodcut, representing a table-clock.

(*To be continued*).

BRONZES.

By C. D. E. Fortnum, F.S.A.

Continued from page 107.

OUR object is to give a general idea of the mode of casting in bronze, rather than to enter into all the details of its varied methods as practised by different artists at various times, and by different founders of our own day, many of whom have adopted special arrangements applicable to the works upon which they may have been engaged. Thus moulds of plaster of Paris have been made directly upon leaves and sprays of trees and flowers, which, charred in the furnace, have been readily shaken out in the form of charcoal dust; the liquid metal has then been poured in, and the mould broken to remove the casting. Casting in sand is not so applicable to works in the round, though much used for models in rilievo.

After removal from the mould, and abstraction of the core, a greater or less amount of finishing is required upon the work, depending upon the degree of elaboration bestowed by the artist upon the wax or clay model, and the success with which the casting has been effected. Whatever in the way of filing, chiselling, chasing, punching, or polishing is done to the bronze should be the work of the master's hand, or at least under his immediate supervision. In this consists much of the artistic charm of the earlier Renaissance works which in so many cases are, with the exception of the removal of asperities, in the state in which they left the mould. The sculptor's wax model, upon which he has bestowed his painstaking thought and art, and which, like the painter's finished sketch, bears the reflex of the artist's mind, is simply changed into an enduring material, to which time and its modeller's own hand have imparted only a richer tone of surface colour. Unfortunately the processes of finishing are now too frequently delegated to other hands, dexterous perhaps in the manipulation of tools, but having neither the experience nor ability to comprehend the spirit of the sculptor's model.

Groups and figures in violent action are generally cast in different pieces, which are joined by soldering or by dovetailing: the joints having been securely fixed in a surrounding bed, the melted metal is poured in, and the work carefully filed down to an evenness of surface. The casting of works in *rilievo*, when large and the figures much raised in relief, is effected in a nearly similar manner, excepting that the core is more independent of the model. Sand casting is only applicable to works in lower relief, and free from undercutting.

In bronze, and in latten or soft brass, many works have also been produced by hammering—the *sphyrelaton* or *toreutic* work of the ancients, the *repoussé*, or beaten work, of our own day. But the pure copper being more ductile and malleable than its alloys is better adapted to this class of work although the ancients for the most part fashioned their unsurpassed hammered works in a malleable bronze.

This beaten work is produced on the same principle as that of the goldsmith. The design is outlined on the metal plate selected, and by means of variously formed hammers and punches is beaten out from behind, the figures of the subject being gradually brought into relief; the finishing of the details is worked upon the face; the plate, if necessary, being filled in behind by a composition of wax, pitch, and other substances to form a resisting mass sustaining the rilievo; the stamp and chasing tools complete the finish. A more mechanical method is to beat the metal plate into a mould, formed of hard wood or harder metal, upon the surface of which the design has been carefully incised in intaglio: finishing afterwards by punching and chasing. Machine-stamping into or with a die or "force" is largely used in the manufacture of light brass fittings and ornaments. Coins and medals, when not cast, are stamped in the ordinary manner in a steel die.

The next care is to impart an even colour to the surface, for when finished by any of the processes of working—by the hammer, the furnace, the roller, or the press—the object naturally retains the original garish colour of the metal. By exposure to the air a gradual chemical action takes place, and the surface assumes a natural patina or tint, varying with the nature of the alloy and the atmosphere to which it is exposed. But it has been more or less the practice from ancient times to give an artifical colouring to the metal by the application of various mixtures, known as pickles; and by processes, some of which have been kept as precious secrets by their discoverers. We may describe some of these which are more generally known.

Small objects of copper, as medals, coins, &c., obtain their liver colour by the following means: the medal, after being strongly heated, is washed with spirits of turpentine, which becomes decomposed, leaving a film of resin of a reddish colour firmly and evenly attached to the surface of the piece. A more simple process for the medal struck, as is usually the case, from soft copper, is by heating and then rubbing the surface with the peroxide of iron or jeweller's rouge. Another and more lasting method, equally applicable to bronze medals, is by applying to them a solution consisting of muriate of ammonia (sal ammoniac) one part, subacetate of copper (verdigris) two parts, dissolved in vinegar by boiling and carefully skimmed. Diluted with water until no further precipitate falls, and again boiled, it is at once poured over the pieces, so placed in a copper pan that every part is touched by the liquid. The action of the acid must be watched that it does not go too far, and when the surface has assumed the required colour, the pieces are carefully washed to remove all acid, dried, and polished with a brush. A Chinese process is said to be by means of a mixture of cinnabar, verdigris, alum, and sal ammoniac, with which the object is pasted over, then gradually and uniformly heated; after cooling it is washed and polished. Nothing can exceed the beauty and variety of colour imparted by the Chinese and Japanese to their admirably cast and finished works in bronze.

Various modes have been proposed to imitate the natural *patina* which antique bronzes take after being long buried in the ground. The patina varies with the nature of the soil or because of objects in the immediate vicinity. Thus, marshy and peaty soils will give that low olive tone of colour and beautiful surface known as the Pontine and Maremma patinas; and contact with iron will impart a rusty tint. In some cases the surface acquires the smoothness and brilliant colour of malachite, while every detail of the most minute workmanship is preserved. Volcanic soils act strongly on the metal, as does the nitrous soil of Egypt, and leave the surface rough, while in many instances it is blistered and distorted out of form. These states of the surface and of the metal beneath, arising from the slow and regular action of natural causes, vary considerably. In some examples, more frequently afforded by the dry climates of Upper Egypt and Greece, the surface of some parts is left purely metallic and free from oxidation; this is also the case with many bronzes which have been constantly beneath fresh water, as, for instance, weapons, &c., dredged up from the bed of the Thames and other streams, from peat bogs, &c. On the other hand, many examples occur in which, notwithstanding the more or less perfect preservation of the form and details, the whole interior mass has been converted into a crystalline red oxide of the metal, hard and grating to the knife-edge, and having on the external surface a thin film of carbonate, of close and even grain. Occasionally small portions of the black oxide of copper may be found, but it seems to be the invariable rule that, where an antique bronze is covered with a green patina, a thin stratum of the crystalline red oxide may be traced between it and the metal.

(*To be continued.*)

THERMOMETERS.

WE cull the following from a most able and instructive lecture on mathematical instruments, delivered at a meeting of the Society of Arts, by Mr. Mattieu Williams, and a report of which appeared in the Society's Journal :—

Our primary ideas of heat are dependent upon our sensations of temperature.

That these sensations are of but small value for measurement of temperature is easily tested by taking three basins, and in the first, placing water as hot as the hand can bear; in the second, cold water; and, in the third, a mixture of equal quantities of the hot and cold water. Then immerse one hand in the first, the other in the second, and after holding them there a few minutes plunge both into the third. This same water will appear hot to one hand and cold to the other.

We must, therefore, find, for mathematical purposes, some other general effect of temperature which is more measureable, and more consistent than our direct sensations. Such is afforded by the increase of the bulk of bodies which accompanies elevation of temperature. I shall call this "expansion," rather than adopt the more fashionable, but barbaric and painfully un-English word, "dilatation."

The common thermometer is an instrument constructed for the measurement of this expansion, which may be of a gas, a liquid, or a solid, and we have, accordingly, air thermometers, mercury thermometers, spirit thermometers, sulphuric acid thermometers, metallic thermometers, etc. To enter upon the details of their construction, and the reason for selecting these diverse materials, according to the applications or range of temperature to be measured, would demand an exposition of the laws of heat. I can, therefore, only briefly explain some leading features in the construction of the most important and largely-used class of thermometers, and define the standard of temperature.

As we well know, the ordinary expansion of water in a tumbler, or other common vessel, is too small to be easily visible. It amounts to only $\frac{1}{23}$ between its freezing and boiling points; that of mercury is $\frac{1}{55}$ in the same range. By causing a wide vessel to overflow into a narrow one connected with it, we can so elongate this small proportion as to render it easily measurable. An ordinary thermometer tube is such a narrow vessel so connected; its bore is of thread-like slenderness, and its bulb is comparatively of great capacity. If the bulb is filled with liquid, and then, by a rise of temperature, the liquid is made to overflow, this overflow is caught in the tube, it is there outstretched, and its expansion is visually (though of course not actually) magnified for the purposes of inspection and measurement. Strictly speaking, the actual expansion is not thus indicated, because the glass vessel itself also expands, though in a much smaller degree. The visible expansion is the difference between that of the mercury and the glass.

As temperature is progressive, and has neither beginning nor ending, so far as our knowledge goes (absolute zeros of temperature have been imagined but never physically demonstrated), we must select a starting point of natural and invariable temperature. Two such were suggested by Sir Isaac Newton, viz., the temperature of melting snow or ice, and that of pure water boiling under a given atmospheric pressure.

These supply us not only with fixed starting points, but also with a definite distance, or range of temperature, between them. This interval, between the thawing of ice and boiling water, is the universally-adopted unit of temperature. It is a natural fixed and easily definable and verifiable quantity. The "degrees" of our thermometer scales are artificial and arbitrary sub-divisions of this natural interval.

In the Centigrade scale it is divided into 100 parts; in Reaumur's scale into 80 parts; in Fahrenheit's scale into 180 parts, with an imaginary and false zero at 32° below thawing point.

I need scarcely say that the first essential to the accuracy of a thermometer is that the tube shall be of equal capacity throughout, or, if variable, that the graduation shall vary accordingly. This is tested by the process called "calibration," *i.e.*, by passing into the tube a little mercury, say sufficient to measure half an inch when in the tube, then by running this along the tube, and measuring it at different parts, any irregularity of bore will be at once seen by variations of the length of this little mercurial stick. It must become shorter where the tube is wider and lengthen where it is narrower. The best thermometers are graduated accordingly. The length of the degree in any particular instrument is, of course, determined by the relation of the bore of the tube to the contents of the bulb, and this (after calibration) is tested by immersing it, when filled, first in a mixture of ice and water, marking the height of the thermometer there, and then in the vapour of boiling water under the given atmospheric pressure, and marking again the height thereby attained. The interval between these is then divided to the scale required. Only standard thermometers are thus directly marked; ordinary thermometers are graduated by comparison with the standard instruments, when both are exposed to the same temperature. In Mr. Casella's workshop is a tank with glass sides, heated from below, the water in which may be violently or thoroughly agitated by means of dashers worked by a treadle. The best instruments, next to the "natural standard" thermometers, are compared with the standard by immersing both in this. Ordinary instruments are graduated by comparison in the air of a suitable apartment.

We commonly call these fixed points the freezing and boiling points of water, but I think it would be more correct to call them the thawing and condensing points of water, seeing that if water is kept at rest in a smooth vessel it may fall many degrees below thawing point before it freezes. A rapidly flowing river may do the same. Water may also be raised many degrees above its condensing temperature before it boils. The thawing and the condensing temperatures are not thus variable.

My proposed innovation is further justified by the manner in which these fixed points are actually and practically determined in the fundamental standardizing of thermometers.

The first point is fixed, not by immersing the thermometer in freezing water, but in water cooled down by the thawing of ice. Small fragments of ice are agitated in the midst of distilled water, and the thermometer receives its temperature from the water that is doing the work of thawing, and which is cooled thereby. Formerly, the "boiling point" was determined by immersing the bulb of the standard thermometer in boiling distilled water, but Mr. Casella informs me that, more recently, when the demands of science required subdivision to small fractions of the conventional degrees, the best makers found, in spite of every precaution, serious discrepancies, upon making severe comparisons between the boiling point thus determined on such delicate thermometers—that is, on thermometers in which the stem tube is so fine in proportion to the bulb that there shall be half an inch or more between each degree, and this divided into small fractions.

This discrepancy has been overcome by immersing the thermometer in the vapour of water instead of the water itself, by using an apparatus in which the thermometer is above the water, and is heated by the condensation of the vapour upon its surface. To prevent any loss of heat by its own radiation, the tube surrounding the bulb is double, and the steam occupies the jacket space between the two tubes, as well as the inside of the inner tube.

The filling of a thermometer bulb through so small an aperture as its capillary tube appears, at first sight, a difficult task, but it is easy enough. The bulb is heated and some air expelled by its expansion. Then the end of the tube is immersed in mercury, and as the bulb cools, some of the mercury is forced by atmospheric pressure to occupy the space vacated by the air previously expelled. This is repeated, and the mercury is heated to boiling, if necessary, and the tube entirely filled upon the condensation of its vapour. Finally, the filled tube is raised to just the highest temperature it is intended to indicate, and a blow-pipe jet of flame is thrown upon that part which corresponds to the graduation for this maximum temperature. As the glass fuses it is drawn out and asunder there, and is sealed while quite full of mercury. On the cooling down and contraction of the mercury, the space left above it in the tube is thus a vacuum, so far as air is concerned.

The existence of such a vacuum may be tested by simply inverting a mercurial thermometer. In a vacuum the mercury runs freely down to the end of the tube, if the bore is of moderate size, if large, it even falls with a "click." If the bore is very small, a jerk is necessary to overcome the adhesion of the mercury to the sides of the glass.

The bulbs are blown by sealing (*i.e.*, melting together) one end of the tube, then heating that end, and blowing it out while red hot. The accuracy with which this is done by the glass-blower is marvellous. He can regulate the size of the bulb to that of the diameter of the tube so nearly, that grosses of common thermometer tubes are blown to suit grosses of ready engraved scales, and the same man can blow for a scale $\frac{1}{8}$th of an inch to a degree, $\frac{1}{10}$th, $\frac{1}{20}$th, and so on, as required, and do it within a very small range of error.

Another curious fact is, that these men, with very few exceptions, are Italians, or of Italian parentage, and not only do they all come from Italy, but from one part of Italy. They are Milanese, and they make barometers and other glass philosophical instruments demanding quantitative accuracy.

The founders of the trade were Tagliabue and Pastorelli, whose names may still be seen on old barometers. Among their pupils and worthy successors are Messrs. Negretti and Zambra, and Mr. Casella. These and others are naturalized and patriotic Englishmen, though bearing Italian names, and worthily proud of their Italian parentage.

The neighbourhood of Hatton Garden was the original place of settlement of these scientific Italian artisans, and thereabouts they are still to be found. They and their humbler artistic compatriots have established a curious little Italy here, and across Holborn, around Leather Lane.

There is a multitude of other thermometric devices, self-registering and otherwise, in which air or other liquids take the place of the mercury; but there are good reasons why mercury is preferred for all ordinary purposes.

1st. It is a better conductor of heat than any other available liquid. The importance of ready conduction may be shown by the simple experiment of passing the bulb of any thermometer rapidly through the flame of a spirit lamp. The indicating liquid will at first fall in the tube and afterwards rise, as though the contact of the flame lowered the temperature, and emergence from the flame raised it. This apparent paradox is due to the expansion of the glass before sufficient time has elapsed for the heat to be communicated to the mercury. A water, spirit, acid, or glycerine thermometer receives the heat much more slowly than the mercury. 2nd. The quantity of heat required to raise a given bulk of mercury one degree is less than half of that demanded for raising temperature of the same bulk of water to the same extent.

A third and very important advantage of mercury is the great range between its freezing and boiling points. It is obvious that a water thermometer would be useless for any temperature below its freezing point or above its boiling point, but this is not all. It would not do even to approach these, for all liquids, and more especially water, are subject to serious irregularities in their co-efficients of expansion (*i.e.*, the amount of expansion produced by a given increase of temperature) as they approach the temperature at which they solidify or vaporize. They are only available for a certain middle range between these, and they vary a little even then, expanding rather more for each degree as the temperature rises. In the case of mercury, its expansion from 0° to 1° Centigrade is 179 millionths; between 350° and 351° it amounts to 197 millionths, progressively advancing between these.

Those large public thermometers, displayed on the door-posts of opticians and other shops, are usually filled with sulphuric acid, which has a much greater range than water, between freezing and boiling.

Alcohol is used for temperatures approaching or falling below the freezing point of mercury.

As gases expand so much more than mercury for a given increase of temperature (above 18 times as much, and all gases alike), and as they expand more uniformly than liquids, it might be supposed that air thermometers should be commonly used.

The principal reason why air is so little used as a thermometric indicator is, that, in common with other gases, it is almost, if not quite, a nonconductor of heat, and that radiant heat may pass through it so largely as scarcely to affect it.

The form of air thermometer, with two bulbs connected by an U-shaped tube, in which is a bar of coloured liquid midway between the bulbs, that is driven down the stem of the warmer bulb and up that of the cooler, is Leslie's differential thermometer, which did good service in the hands of its inventor, but is now almost superseded by the *Thermopile*, a small thermo-electric battery, which develops an electric flow when one face is made warmer than the other; the electric disturbance being rendered evident and measurable by the deflection of a magnetic needle.

PRESERVATION OF IRON FROM RUST.

SOME practical experiments have just been made in connection with a new process of coating iron or metal objects generally with platinum, either to preserve them from oxidation or to fit them for such purposes of ornamentation as require a brilliant and permanently lustrous surface. It is the invention of a French chemist named Dodé, who carried out the experiments in person, Messrs. Johnson and Matthey placing one of their muffle furnaces at his disposal for the demonstration. M. Dodé on some rough cast iron furnished by the Carron Company, and on a piece of steel plate of which Thorneycroft's torpedo launches are made. He commenced by painting them over with a blue pigment, said to be a compound of borate of lead, oxide of copper, and turpentine. They were then placed in a muffle furnace, and brought to a red heat, and on being cooled were found to be covered with a perfectly homogeneous black enamel. Some of these are then very lightly varnished with the platinum solution, which was said to be composed of borate of lead, litharge, chlorate of platinum and ether, and exposed to the heat of the muffle furnace, and as soon as the volatile solvent was driven off, and had ceased smoking, they were withdrawn, and found to be covered with a dull white metallic surface, sufficient, however, as the patentee explained, to permanently secure them against oxidation. Where it was desired to produce a brilliant polished surface a second coat of what may be called the preparatory enamel was given, and the article was again brought to a red heat in the furnace. On the platinum compound being applied to this doubly enamelled foundation, a brilliant, highly-polished surface was at once produced. The most remarkable feature of the very simple process was the extremely minute portion of the platinum compound necessary to cover, say, a square foot of surface. This, and the fact that the ore of platinum is used, accounts for the low price at which M. Dodé asserts metallic surfaces can be guaranteed against rust. It was stated that, according to the thickness of the platinum coating, the cost of the process would vary from 3d. to 1s. 3d. per square foot.

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PATENTS.

Applications for Letters Patent.

527. Alexander Melville Clark, of Chancery Lane, in the county of Middlesex, Patent Agent, for an invention of "Improved Striking or Chiming Mechanism for Clocks." A communication to him from abroad by William Lindon, of Brooklyn, in the county of Kings, state of New York, United States of America. Dated 10th February, 1879.

529. Thomas Henry Blake, of Sheffield, in the county of York, Secretary to Edwin Round and Son (Limited), Electro Platers and Manufacturers, 36, Holy Street, Sheffield, for an invention of "An improved process of Electro Plating by an amalgamation or combination of silver and alloys of tin and other metals to be called 'silverette.'" Dated 11th of February, 1879.

554. William Wright, of Birmingham, in the County of Warwick, jeweller, for an invention of "Improvements in scarf rings, which improvements are applicable to brooches, dress-holders, and such like articles." Dated 12th February, 1879.

697. Joseph George Rollason, of Birmingham, in the County of Warwick, manufacturing jeweller, for an invention of "Improvements in solitaires and studs, which improvements are applicable to other like purposes." Dated 21st February, 1879.

701. Felix McIlvenna, of Wood Street, in the borough of Liverpool and county of Lancaster, for an invention of "Improvements in and appertaining to solitaires and studs." Dated 21st February, 1879.

Patents Sealed.

3082. Hermann Francis Jung, of 4, Charles Street, in the parish of St. James's Clerkenwell, in the county of Middlesex, Watchmaker, for an invention of "Improvements in watches and other time-pieces." Dated 3rd August, 1878. [Extended to 6th Febrnary, 1879.]

3271. Friedrich Hermann Felix Engel, Civil Engineer and Patent Agent, in the City of Hamburg, Germany, for an invention of "Improvements in stud fastening." A communication to him from Otto Rafflenbeul and A Kahl, both of Hamburg, in the German Empire. Dated 19th August, 1878.

Notices to Proceed.

3894. Henry Payton, of Charles Payton and Sons, of Birmingham, in the county of Warwick, Manufacturing Jewellers, has given notice in respect of the invention of "An improvement or improvements in fastenings for bracelets, scarf rings, finger rings, and other like articles."—A communication to him from abroad by John Mendelow, of Paris, in the republic of France.

4069. Thomas Winkles and Thomas Moxon, both of Birmingham, in the county of Warwick, have given notice in respect of the invention of "Certain improvements in swivels for securing watches to their chains, also applicable to other analogous purposes."

4536. Joseph Tranter, of Birmingham, in the county of Warwick, Jeweller, has given notice in respect of the invention of "Improvements in fastenings for bracelets, necklets, scarf rings, and lockets."

Patents which have become Void.

520. Giuseppe Zaffira, of Pentonville Road, in the county of Middlesex, Engineer, for an invention of "Improvements in watches, clocks, and chronometers."—Dated 9th February, 1876.

Grants of Provisional Protection for Six Months.

283. To Louis Desire Bodin, of Boulevard Saint Denis, 1, at Paris, for the invention of "An improvement in the manufacture of jewellery and ornaments in enamel and jet on all metals."

164. To Howard Grubb, of Leinster Road, Rathmines, in the county of Dublin, Ireland, for the invention of "Improvements in stereoscopes."

280. To William Gardner, the younger, of Pendlebury, near Manchester, in the county of Lancaster, Watch Maker, and William Miles, of Birmingham, in the county of Warwick, Jeweller, for the invention of "Improvements in watches."

284. To William Holland, Old Chester Road, Rock Ferry, in the county of Chester, Watch Manufacturer, for the invention of "Improvements in and applicable to watches."

554. To William Wright, of Birmingham, in the county of Warwick, Jeweller, for the invention of "Improvements in scarf-rings, which improvements are applicable to brooches, dress-holders, and such like articles."

Patents Granted in Foreign States.

German Empire.

4130. A Reinhardt, of Chemnitz, for "A watch-escapement independent of the motive power."—Dated 21st May, 1878.—Class 83.

4196. F. Leichert, of Mayence, for "A guard for watches."—Dated 13th May, 1878.—Class 44.

4202. E. A. Roulin, of Paris, for "Studs in pieces."—Dated 13th July, 1878.—Class 44.

4227. E. Messter, of Berlin, for "Modifications in microscopes."—Dated 25th June, 1878.—Class 42.

4378. P. A. Baron, of Paris, for "A bracelet, necklace, and head-dress, consisting of a number of links of flexible wire."—Dated 9th August, 1878.—Class 3.

80. C. Hahlweg, of Stettin, for "An implement for mounting stones in watches.—Dated 22nd July, 1877.—Class 83.

4529. W. König, of Brunswick, for "A cooking clock."—Dated 7th, February, 1878.—Class 42.

4550. M. Sachs, of Nürnberg, for "An apparatus for weighing and registering gold."—Dated 27th June, 1878.—Class 42.—Addition to Patent No. 3257.

4587. T. Weisser, of Furtwangen, for "A self-regulating calendar-clock."—Dated 23rd June, 1878.—Class 83.—Addition to Patent No. 3242.

France.

125,629. Guerand, for "Crowns applicable to the shanks of remontoir watches."

125,812. Guilmet, for "A clock with a conic oscillating pendulum."

125,897. Merique, for "A universal watch-key."

99,783. Haas, jun., and Co., for "A watch with a perpetual motion."

122,057. Ratel, for "A ratchet-drill for watchmakers."

125,915. Humbert-Ramuz and Co., for "A central datum index for watches."

126,109. Tetzis, for "Mechanism for pendulum and other clocks."

125,931. Hue, for "Improvements in aneroid barometers."

Belgium.

47,172. F. J. Perkins, for "Improvements in regulators for watches, portable clocks, and other time-pieces."—English Patent, 11th December, 1878.

47,132. D. and M. Löwenthal, for "Fastenings for bracelets, &c., necklaces and other objects."

Austria.

24. H. Druk, of Klagenfurt, for "A sidereal clock for finding out the time and date by the position of two stars."—Class 7.

62. M. Kottek, of Vienna, for "A two days remontoir watch."—Class 7.

107. F. C. F. Schlesicky-Ströhlein, of Frankfort-on-the-Main, for "Improvements in spectacles."—Class 7.—German Patent, 16th December, 1877.

United States of America.

210,704. Thomas H. Mott, of New York, N.Y., for "Calendar-clocks."—Application filed 20th July, 1878.

210,712. Jonathan R. R well, of Hill, N.H., for "Lenses for spectacles."—Application filed 24th June, 1878

210,755. John Connor, of Jersey city, N.J., for "Lock-work attachments for clocks."—Application filed 13th March, 1877.

210,806. S. Emerson Root, of Bristol, Conn., for "Clock-dials."—Application filed 22nd August, 1878.

211,071. Edward Weston, of Newark, assignor to Edward E. Quimby, of Orange, N.J., for "Nickel-plating."—Application filed 13th November, 1178.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Bauman, Eugen, Market St., Pontypridd, jeweller, &c. Jan. 30. Hodgson & Haigh, sols., 13, Waterloo St., Birmingham.

Cowen, Maurice, trdg. as E. Cowen & Co., Withy Grove & Aberdeen St., Manchester, importer of clocks & jeweller. Jan. 30. C. B. Hodgson, & Haigh, sols., Waterloo St., Birmingham.

Hakowski, Joseph, 40, Gerrard St., Soho, designer, and silversmith. Jan. 29. Miller, Smith, & Bell, sols., 3, Salter's Hall Court, Cannon St..

Lowry, James, Hyde Rd., Ardwick, Manchester, watchmaker. Jan. 30 W. Vaughan-Jones, sol., Bridge St., Manchester

Ritson, Wm., Dalton Rd., Barrow, watchmaker and jeweller. Feb. 1. F. Taylor, sol., Barrow.

Taylor, Dickinson, Bacup, Lancashire, jeweller. Feb. 1. G. Ashworth, sol., Waterfoot.

White, Helen Maria Watts, 60, Cornhill, and 86, Albany St., Regent's Park, jeweller. Gush & Phillips, sols., 3, Finsbury-circus.

Jaques, Wm., 101 Tachbrook Street, Pimlico, pawnbroker and jeweller, and 24, Sussex Street, Pimlico, auctnr. Feb. 1. W. E. Goatly, sol., 152, Westminster Bridge Road.

Sisson, Joshua, Bolton, watchmaker, Feb. 5. Dowling and Urrys sols. Bolton.

Tonks, Leigh, trdg as Metcalf & Co., 19, Cockspur Street, Pall Mall, late Graham Street, Birmingham, jeweller. Feb. 7. W. O. Rew, sol., 31, New Broad Street.

Ziegelbauer Chas. Geo. Julius, Fleet Street, Torquay, watchmaker. Feb. 4. T. C. Lindop, sol.

Cooper, Wm., Nursery Street, Sheffield, watchmaker. Feb. 4. R. Fairburn, sol., Sheffield.

Arrowsmith, Robert, trdg. as Robt. Arrowsmith & Co., Albion Street' Birmingham, and Grove Villa Road, Handsworth, jewellers' factor. Feb. 11. M. A. Fitter, sol.

Walpole Eliza, trading as E. & H. Walpole, Horse Fair, late Lee Bank Read, both Birmingham, gilt jewellery manufacturer, Feb. 10. Hawkes & Weekes, sols., Temple Street, Birmingham.

Steiner Leon, & Alexander Stoessiger, 64, Hatton Garden, watch importers. Feb. 14. At A. Fleet, sol., 39, Hatton Garden, Mar. 10. at 11.

Bukhsh Peer, 59, Russell Square, dealer in precious stones. Feb 10. At Inns Court Hotel, 269, High Holborn, March 6 at 3. Lewis and Lewis, sols., 10, Ely Place.

Moulden, Christian Philip, Lamb Street, Coventry, watchmaker. Feb. 13. O. Minster, sol., Coventry.

Goodman, Selig, Queen's Buildings, Deansgate, Manchester, and Brunswick Street, Chorlton-on-Medlock, jeweller. Feb. 12. J. Sampson, sol., South King Street, Manchester.

Lowe, James, Church St., Over Darwen, watchmaker Feb. 7. F. G. Hindle, sol., Over Darwen.

Lazarus, Barnett, trdg. as City of London Artists' Association, 1, 2, Southampton Row, Holborn, and 27, Brunswick-Sq., diamond merchant, &c. Feb. 10. G. & W. Webb, sols., 11 Austin Friars.

Bellamy, Wm., Gt. Russell St., Birmingham, metal worker & electro-plater & Summer Row, Birmingham, tobacconist. Feb. 20. At Wright & Marshall's, sols., New St., Birmingham, Mar. 7, at 4.

Billings, Jno., High St., Ventnor, lapidary & jeweller. Feb. 19. At Grand Hotel, Colmore Row, Birmingham. Mar. 11, at 11. T. H. Urry, sol., Ventnor.

Challen, Wm. King's Rd., Brighton, jeweller. Feb. 22. At F. W. Henry's, sol., 7 Furnival's Inn, London. Mar. 14, at 2.

Flower, Walter Lewis, 73, Jermyn St., St. James's, & Merton, jeweller. Feb. 21. At Inns of Court Hotel, High Holborn. Mar. 10, at 2. A. Leslie, sol., 34, Conduit-St.

Pairpoint, Edwd., Greek St., Soho, & Enfield Rd., Tottenham Lane, Hornsey, silversmith and plater. Feb. 12. J. R. Tomkin, sol., 9, Great Russell St.

Spicer, Edwd. Anthony, and **Wm. Bellamy**, Gt. Russell St., Birmingham, metal workers and electro-platers. Feb. 20. At Wright & Marshall's, sols, New St., Birmingham. Mar. 7, at 3.

Spicer, Edwd. Anthony, Great Russell Street, Birmingham, and Summer Lane, Erdington, metal worker and electro plate (sep. crdtrs). Feb. 20. At Wright and Marshall's, sols., New Street, Birmingham. Mar. 7, at 3½.

Whitaker, Edwin, and **Fredck. Land**, Wakefield and Mexborough, watchmakers and jewellers. Feb. 15. Dixons & Horne, sols., Wakefield.

White, Beren, 21, Parker Street, and 44, Lime Street, Liverpool, jeweller. Feb. 17. J. C. Parkinson, sol., 11, Lord Street, Liverpool.

Dividends.

Nelson, Horatio W. (Liq.), City Road, jeweller. 1st div. 1/11; W. H. Pannell, 1, Guildhall Chambers.

Trustees Appointed.

Burrows, Henry (Liq)., Stockport Road, Manchester, jeweller, Tr., J. J. Graham, Norfolk Street, Manchester, accountant.

Schuler, Isidor, trdg. as **Schuler** & Co. (Liq)., 34, Hatton Garden, and Somerleyton Road, Camberwell, jeweller. Tr., J. Andrews, 8, Ironmonger Lane, accountant.

Wallace, Jno., Midsteeple Buildings, Dumfries, watchmaker. Tr., J. Miller, Glasgow, accnt. Com., J. H. M'Gowan, Dumfries, sol., and T. Lawson, Buchanan Street, and A. Boyack, cigar merchant, both Glasgow.

Scotch Sequestrations.

Chalmers, David, Pottinger, Stromness, Orkney, watchmaker. Feb. 18, with protn. Tr. and Com., Town Hall, Kirkwall. March 1, at 12. Claims by June 18. Agent, W. Cowper, Kirkwall, sol.

Dissolutions of Partnerships.

Newsome & Yeomans, Coventry, watch manufacturers. Feb. 5.

Owen & Bottomley, Sheffield, silversmiths. Jan. 21. Debts by Lewis T. Owen.

White & Campbell, 133, New Bond Street, goldsmiths. Dec. 31. Debts by Thos. White.

Bevis & Day, Red Lion Square, gold and silversmiths. Jan. 17. Debts by Wm. Chas. Day.

Grimshaw & Baxter, Goswell Road, watch tool dealers. Jan. 1. Debts by Thomas Baxter.

Pennington & Tainsh, 37, Tennant Street, Birmingham, manufacturing jewellers. Jan. 7.

Last Days for Lodging Claims.

Burrows, Hny. (Liq.), Stockport Road, Manchester, jeweller. Clms by March 15 to J. J. Graham, 13, Norfolk Street, Manchester, acct.

GOLDSMITHS' COMPANY'S PRIZES.

The Goldsmiths' Company have offered two prizes of £50 each and three of £25 each for designs for works in the precious metals. A travelling scholarship of £100 per annum may be awarded to a student who has shown exceptional talent, and who shall have obtained a prize for design for three successive years.

To **Renovate Files**.—The file must be first cleansed from all foreign matter, and then dipped in a solution of one part nitric acid, three parts sulphuric acid, and seven parts water; the time of immersion will be according to the extent the file has been worn, and the fineness of the teeth, varying from five seconds to five minutes. On taking it out of the mixture, wash in water, then dip in milk of lime, wash off the lime, dry by a gentle heat, rub over equal parts of olive oil and turpentine, and finally brush over with powdered coke.

Allgemeines Journal der Uhrmacherkunst.

Illustrirte Fachzeitschrift fur Uhrmacher.
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This journal appears weekly, and will be sent post-paid for 2s. 6d. per quarter or 10s. per annum. Single copies 4d. Advertisements are charged 3d. per five-parted line.

The "Allgemeine Journal der Uhrmacherkunst" has taken upon itself the task of improving the art of watchmaking, and to protect and further the interests of the trade.

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THE PLACE OF JEWELLERY IN ART.

A Paper read at the Social Science Congress, Cheltenham.

By Edward J. Watherston,

Member of the Society of Arts.

(*Concluded from page* 109.)

In our own days, probably, harmony of colour is even less studied, as regards jewellery, than symmetry of form. And yet the matter is more important, in an artistic sense, in modern England than it was in ancient Greece. The Greeks knew only one light, that of the sun, and could measure the effect of colours accordingly; while we, in our northern cloud-laden atmosphere, are reduced for a great part of the year to artificial illumination, which greatly changes the effect of tints. Thus jewels, entirely fitting the wearer in the light of the sun's rays, may have a very bad effect under jets of gas; and what often will appear beautiful under a cloudy sky may produce the contrary effect in a ball-room. But, aside of these special considerations, there are others, of a general nature, the perception of which is far from familiar to even highly-educated persons. Outside the circle of pure art-students there are few who are aware that the harmony of colours consists not in uniformity but in contrasts. As one tone in music, repeated uniformly, would constitute no melody whatever, but rather wearisome torment, so neither one colour will constitute beauty, except in juxtaposition to others. To create beauty there must be contrasts, and it may be laid down as a general rule—which, however, like all rules, has its exceptions—that the greater the contrast the greater the beauty. It might assist many ladies, entirely ignorant of the fact, to know that pure red is the most perfect contrast to pure green; that pure yellow is the most perfect contrast to pure purple; and that pure blue is the most perfect contrast to pure orange. All perceive the effect in the harmonious grouping of colours, but as yet there are few who have made study of the causes. It seems rather singular, considering how careful the sense of hearing is trained with us, to distinguish the minutest shades of sound. There are none assuredly who will assert that the eye is inferior to the ear; but still, for all that, the education of the ear is developed to the highest degree, while that of the eye is comparatively neglected. It is one of the anomalies of modern art education.

There can be no doubt that the wearers of jewellery, alike with the makers, would derive very great advantage if they would go back somewhat to the ancient Greek model, in studying the first principles of personal ornamentation. But something more is required. It is that all the best articles designed to adorn the human figure, in the noblest sense, whether of gold, silver, or precious stones, should not be made merely to gratify the passing whim of individuals, or the exigencies of ever-fleeting fashion, but should invariably be products of art. Mr. Ruskin in his "Political Economy of Art," speaking not only of jewellery but of goldsmith's ware in general, refers to this important question with his usual eloquence and terseness. "So long," he says, "as fashion has influence on the manufacture of plate, *so long you cannot have a goldsmith's art in this country.* Do you suppose any workman worthy the name will put his brains into a cup, or an urn, which he knows is to go to the melting-pot in half a score years? He will not; you don't ask or expect it of him. You ask of him nothing but a little quick handicraft—a clever twist of a handle here, and a foot there: a convolvulus from the newest school of design, a pheasant from Landseer's game cards, and a couple of sentimental figures for supporters, in the style of the signs of insurance offices. Then a clever touch with the burnisher, and there's your epergne, the admiration of all the footmen at the wedding breakfast, and the torment of some unfortunate youth who cannot see the pretty girl opposite to him through its tyrannous branches. But do you really suppose that *that* is goldsmith's work? *Goldsmith's work is made to last, and must be made with the man's whole heart and soul in it.*"

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JOURNAL.
W. H. TILBY

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

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No. 47.—Vol. IV.] APRIL 5, 1879. [Subscription, 5s. per Annum. Post Free.

HOROLOGY.

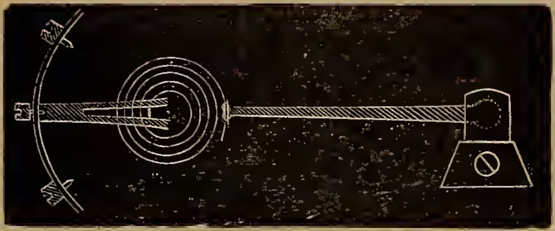
(*Continued from page* 114.)

XL.—Adjustments to Positions, Isochronism, and Compensation.

IN our last, on the subject of adjustment to positions, we endeavoured to show that it can be accomplished on the principle of presenting equal surfaces of the pivots of the balance to friction ; for if equal surfaces touch equal surfaces in all positions during the oscillation of the balance, the friction must be equal in all positions ; and if the friction is in all positions the same, the arcs of vibration of the balance will also be the same in all positions; and since equal arcs of vibration are performed in equal time, the watch will in all positions run alike. Now, directly from the above reasoning we infer, that if the arcs of vibration are unequal in different positions, the friction must be unequal; and we are, therefore, enabled to determine inequality of friction, by observing the arcs of vibrations; and since we know that the lesser friction produces the greater arcs of vibration, we also know in which position to remedy the inequality in the friction. We have thus briefly stated our reasoning, for the purpose of contrasting it with the method generally adopted amongst watchmakers to determine unequal friction, which consists of observing the running of the watch, and then altering the condition of the pivots according to the difference of the time it indicates in different positions during the same number of hours, and on the theory that the watch will go faster with less friction, and slower when the friction is greater. But we may ask the question, why will it go faster with less friction, and slower with more? If we admit that there is such a thing as a principle of isochronism in the hair-spring under certain conditions, which would cause arcs of vibration of unequal extent to be performed in the same time, we could not infer that the advocates of this theory supposed such a spring to be in the watch, for, as we have just said, we know that less friction produces greater arcs of vibration. But they say less friction makes the watch go faster ; and if such a hair-spring is not supposed to be in the watch, our question is equally unanswerable, for our experience teaches us that, according to circumstances greater arcs of vibration may be performed either slower or faster. The fact is, that, as to adjustment to position, the faster or slower running of a watch proves nothing.

But we think we have sufficiently indicated the means of adjusting to position, and will, therefore, proceed to the adjustment of isochronism. We promised in our last, to furnish a translation of Professor Phillips' theory, a high authority on the subject; but as the majority of our readers have unfortunately not had the opportunity of becoming acquainted with mathematical logic, they would be unable to follow the learned professor's high reasoning throughout, and we have thought it best to present the subject in such a form as to be intelligible to all. Much has been written on the inexhaustive subject of isochronism, but very little is accessible to the majority of practical men. From this category we must, however exclude the essay on the balance spring by Moritz Immisch, an adjuster of repute, who has dealt with isochronal adjustments in a masterly way. We think we shall best serve our readers by quoting from his able treatise such passages as the present purpose requires. "If a piece of spring," writes Immisch, "say part of a main-spring, is fixed at one end with its concave side upwards, a weight will draw it lower down than when the convex side is upwards; therefore when a balance-spring is inflected towards that side where the coils recede from the centre, it would oppose less resistance to the balance than on that side where they advance towards it, and the halves of the vibrations would be unequal in length were this not counterbalanced by the circumstance that the strain of the cohesive power of the corpuscles composing it is greater here than when it is inflected the other way. Supposing a spring to have three turns; when inflected one whole turn to make the coils expand, the turns will only be two; when inflected the other way one whole turn, the turns will be four, and, therefore, as 3 : 2 is a larger proportion than 4 : 3, the spring had in the former case to expand more than it had to contract in the latter. If the above experiment with the piece of spring is continued (the convex side being upwards), it will be seen that in the beginning the spring bends closest to the centre, but farther on (supposing the bending force always to act in a rectangular direction to the tangent of the extremity of the free end) the form will soon become of an oval shape, and if the spring should break now it would not be at the point of fixture, but at the point farthest from it. Had the spring broken at the beginning of the experiment, it would have been much nearer to the fixing point. This experiment, rude as it is, proves that the point of the greatest strain moves away from the fixing point when the spring contracts, and approaches towards it when it expands. This is exactly what takes place in every spring. In the case of a flat spring, that strain is modified by the relative position of the ends. The following experiment, which can easily be repeated by any one, will prove this beyond a doubt.

"I fixed the outer end of a spring of five turns to a movable stud or lever turning on pivots at some distance from the spring. One of the balance arms had a long notch in it to receive a stud in place of the collet, to which the inner end of the spring was fixed, which could be easily moved to and fixed at any distance from the centre. For setting the balance in motion, the lever, of course, moved to and fro, turning in its pivots always in the same direction as the balance moved, no matter whether the spring was fixed as in the drawing or the reverse way. I found the lever to move very differently according to the relative position of the ends; sometimes equally to and fro, sometimes much more when the spring expanded than when it contracted. These differences were about the same in each coil, provided the relative positions of the ends were the same, only they were more conspicuous as the spring got shorter. The greatest deviation of the lever I found when the ends were were fixed about half-way, making 4½, 3½ and 2½ turns. In tapering the outer coil of a similar spring towards the end, the movement of the lever became much less, because here the point of the greatest strain was confined to the immediate neighbourhood of the fixing point. It follows that the greatest deviation of the lever from its quiescent position denotes that the greatest strain is as far from the end as it possibly can be. These imperfections, if I may so call them, are made use of to procure isochronism in flat springs.



"If the strain is too near the end at the commencement of the vibrations, there is not sufficient room for it to advance farther, the cohesive power of the particles of the extremities of the spring will be overstrained when the vibrations get larger, causing them, of course, to be quicker. On the other hand, when the strain at the beginning of the vibration is farther from the end, it has more scope to travel forward, the momentum of the balance will be more powerful (comparatively speaking) in long vibrations, the point of rest before the return of the balance will be prolonged, and, consequently the long vibrations will be slower. There is, therefore, a certain relative position in every flat spring where the long vibrations are slowest, and another where they are quickest, but whether the difference between the two is sufficient to meet the exigencies of the case, is another question, and depends on the conditions considered above. That difference, as we have seen in this experiment, decreases with the length of the spring, and it is found by practice that it *increases* with the proportion in which *the distances of the coils from each other are tapering towards the centre.* In a very long spring, when these distances are equal, it is very small. If, as is usually the case, index and curb pins are used to bring the watch to time, this, of course, alters the isochronal properties of the spring. Curb pins can therefore be used to procure isochronism if timing screws are used for rating the watch, but this can only be done within comparatively narrow limits, as when the curb pins are too far removed from the stud, the unemployed end will move slightly in a contrary direction to that of the spring, and as this movement is caused by the strain of the employed part, it will in its turn affect the vibrations. The differences arising out of such a compound motion have no definable limits, and must therefore be avoided.

"In any alteration of the spring effected for the purpose of making the long vibration slower, the weight of the balance should be altered. It is best to operate on a pair of small screws close to the rim of the balance; the changing of the diameter sometimes entirely destroys the beneficial effect the lengthening and shortening of the spring would otherwise have had.

"A greater or less tapering of the distances towards the centre will vary the relative positions of those points where the difference between long and short ones is greatest, and these relative positions must be found out in each case. A flat spring should have about eleven turns. If shorter, it must be harder in proportion, on account of the greater strain. The distance of the coils farthest from the centre should be about twice that of the innermost ones. Formerly springs were often made tapering to procure isochronism. This mode was first employed by Berthoud, and there is no doubt that isochronism must be obtained by that means if the taper is properly proportioned; but the difficulty in the way of making these springs has brought them into disuse. In Brequet springs isochronism is obtained by bending the outer end, and in cylindrical or helical springs by bending both ends into curves towards the centre."

(*To be continued.*)

HALL-MARKING OF WATCH CASES.

THE Committee on Hall-marking has been re-appointed on the motion of Sir H. James, for Sir H. Jackson, and it was agreed that the Select Committee should consist of twenty members. The following gentlemen were selected:—Mr. Bales, Colonel Blackburne, Mr. Campbell-Bannerman, Mr. Courtney, Mr. Orr Ewing, Mr. Freshfield, Mr. Goschen, Mr. Hansen, Mr. Hankey, Sir Joseph M'Kenna, Sir A. Lusk, Mr. Muntz, Sir Patrick O'Brien, Mr. Onslow, Mr. Puleston, Sir Charles Russell, Mr. Talbot, Mr. Torr, Mr. Whitwell, and Sir Henry Jackson,—with power to send for persons, papers, and records; five to be a quorum. The following is a copy of the Bill relating to the Hall-marking of Watch Cases, as printed by order of the House of Commons, 26th February, 1879:—

Whereas the corporations authorised by law to assay and mark gold and silver watch-cases in the United Kingdom are not legally entitled to refuse to mark watch-cases manufactured out of the United Kingdom, by reason whereof watches manufactured out of the United Kingdom are passed off and dealt in as being watches of British manufacture; for the prevention thereof—

Be it enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1. This Act may be cited as the Hall-marking Act, 1879.

2. This Act shall commence from and immediately after the *thirtieth day of September one thousand eight hundred and seventy-nine.*

3. The corporations authorised by law to assay and mark gold and silver plate in the United Kingdom shall not assay or mark any watch-case which is not manufactured in the United Kingdom.

4. If the assayer of any such corporation has reason to believe that any such watch-case sent to his assay office for the purpose of being assayed and marked has not been manufactured in the United Kingdom, he shall not assay or mark the watch-case until there has been produced to him a declaration made and signed before a justice of the peace or some person authorised to administer oaths in the Supreme Court of Judicature, and stating that to the knowledge of the declarant the watch-case has been manufactured in the United Kingdom.

5. If any person knowingly and wilfully makes any false statement in any such declarations, or sends or uses as genuine any declaration purporting to be made under this Act, knowing the same to be false or falsified, he shall be guilty of a misdemeanour, and shall be liable to imprisonment for any term not exceeding *two years*, with or without hard labour, or to a fine not exceeding *one hundred pounds.*

6. A person shall not sell or expose or offer for sale any gold or silver watch-case assayed and marked within the United Kingdom which contains movements manufactured wholly or in part out of the United Kingdom. For the purpose of this Act the word "movements" shall mean every part of a watch except the watch-case and the glass. Every person so offending shall be liable to a penalty not exceeding *fifty* pounds, to be recovered on summary conviction before any court of petty sessions in the manner prescribed by the Summary Jurisdiction Acts.

The above Bill was prepared and brought in by Sir Henry Jackson, Mr. Eaton, Sir Andrew Lusk, and Mr. Torr.

Imports of clocks and watches during the two months ending February 28th, 1879:—

Clocks 93,799, valued at £66,687.

The number of clocks imported during the corresponding period of last year was 88,990, valued at £71,005.

Watches, £72,128; corresponding period of 1878, £66,246.

DUTY AND HALL-MARKING RETURNS.

PARLIAMENTARY returns have been issued of the sums received at the Goldsmiths' halls at London, Birmingham, Chester, Dublin, Edinburgh, Newcastle, Sheffield and Exeter, for duty and hall-marking in each year from 1867 to 1877 inclusive, showing also what monies were paid into the treasury out of the receipts during each year, what the amount of working expenses, and what was the appropriation of the surplus fund, if any. The returns show also the weight of gold and silver respectively that was hall-marked in each of the above years at each of the halls before named. In London the duty on hall-marking amounted to £535,182, of which the Commissioners of Inland Revenue received £452,601. The total weight of metal marked was —gold, 70,317 lbs., and silver, 830,171 lbs. The receipts for hall-marking during the same period were £77,273, and the expenditure £74,157. The balance was carried to an accumulation fund. In Birmingham the sum received for duty amounted to £171,989, for 967,451 ozs. of gold, and 1,355,258 ozs. of silver wares assayed and marked; £37,464 was received for hall-marking.

Mr. R. Giffen, chief of the statistical department of the Board of Trade, on the occasion of the first sitting during the present session of the select committee on hall-marking, stated that he had paid considerable attention at different times to statistics relating to the production and distribution of the precious metals. He found that the amount of gold and silver used in this country for manufacturing purposes was comparatively small in comparison with that which was used for coinage. He had not been able to ascertain whether it was proportionately small in other countries, but he was under the impression that it was so. Within the last twenty years the excess of imports over exports had been about 50,000,000 ounces. Since 1866 the excess of imports of silver over exports had been about 6,000,000 per annum. Duty was only paid upon 800,000 ounces. He accounted for this by the large amount of silver used for electro-plate, and in the manufacture of many articles exempted from duty. The use of silver used in the manufacture of silver-plate seemed to be on the decline of late years, especially since 1820. That was about the time when electro-plate manufacture was introduced. He believed that if the duty upon manufacture were removed, the effect would be that trade would very likely increase. There had not been sufficient time to show that the recent fall in the value of silver had stimulated manufacturers.

Mr. Giffen, in answer to the chairman, Sir Henry Jackson, said he thought the hall-marking, apart from the duty, had a tendency to check manufacture, that it should be made optional, and that the general public did not attach the same importance to it as the trade.

QUERIES AND ANSWERS.

H. B. would feel obliged for information where to obtain a copy of "A Treatise on the Detached Lever Escapement," by Thomas Charles Scotchford. London, 1866.

Old Subscriber.—Where can I buy one of Grove's galvanic batteries, etc.?

Address Messrs. M. Jackson and Co., 65, Barbican, London, E.C., and they will forward you price list of all you require.—[Ed.]

Constant Reader.—Will any reader oblige by giving me the proportionate quantities of silver and copper alloys to be added to standard gold to produce good deep colour in 18 and 15 carat gold; also the best solders for respective qualities, that will not show after colouring.

H. W., Manchester.—Thanks for your contribution; we shall be glad to make use of it in our next.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTROPLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. I.

Before the operation of depositing a metal upon the surface of another is commenced, it is absolutely necessary that the latter should be free from impurities, as the presence of any foreign body, however minute, would prevent proper adherence. The articles which are to receive the deposit are therefore subjected to a cleansing process, varying according to the metals to be operated upon. Copper and its alloys require the most complicated and careful treatment, while in the case of silver, iron, lead, tin, etc., the cleansing process is rather mechanical than chemical.

The preparation of copper and its alloys for deposition demands six distinct operations, viz.:

1. Cleansing by fire or alkalies.
2. Dipping.
3. Dipping in old aquafortis.
4. Dipping in new aquafortis and soot.
5. Dipping in compound acids for a bright or dead lustre.
6. Dipping in nitrate of binoxide of mercury.

Of these six operations, four only are indispensable; the third and the sixth may be omitted in many cases, which will be hereafter indicated.

Cleansing by Fire or Alkalies.—The surfaces of articles to be plated are freed from any foreign substances, especially if of a fatty nature, by heating them over a gentle fire of charcoal, breeze, or spent tan. A muffle furnace, heated up to a dull red heat, is still better, and very small objects may be cleaned in a hot revolving cylinder, something after the style of a coffee-roaster. This fire-cleansing process is, however, not adapted to very delicate work, such as filigree; or table forks and spoons, which must preserve their toughness; or such articles in which the different parts are united with fusible solders. In these cases immersion in alkaline solutions, for a greater or less period of time, according to the nature of the metals, is resorted to. A more or less concentrated solution of potash or soda, soda salt, or pearlash, or, in preference to either of these, caustic potash dissolved in ten times its weight of water, is heated in an iron boiler; and a few seconds' immersion in this solution, when boiling, will suffice to remove any greasy matter. The pieces should not be left too long, particularly if tin-soldered, as the alkali would dissolve the solder, and blacken the copper. The above bath will serve for a long time, and if it has become weak can be revived by the addition of a few fragments of caustic potash. The boiler containing the solution should have a lid to prevent evaporation, or the absorption of the acid vapours of the workshop, which destroy its alkaline and consequently cleansing power.

Dipping.—After the cleansing process just described, the articles are dipped in a bath consisting of:

Sulphuric acid at 66° Baumé 5 to 20 parts (in weight),
Water 100 parts.

Most articles may be dipped while still hot from the preceding process; but certain alloys, known as cast bronze, bell-metal, etc., in fact, any alloy in which tin, zinc, or antimony predominate, must not be so treated, as the sudden cooling will occasion cracks and flaws. Copper may be left in this bath for any length of time without undergoing any alteration, and it is absolutely necessary to leave it until the black coating, binoxide of copper, due to the cleansing solution, is completely dissolved, leaving an ochre red surface, protoxide of copper, which is not affected by sulphuric acid. It must, however, be remarked, that articles combining parts of iron or zinc with the copper, should not remain too long in the liquid, because the sulphuric acid would not fail to act on those auxiliary metals, and it is therefore most practical to abstain from the use of iron, zinc or steel wire and hooks, in the manufacture of copper articles to be plated. Neither would a dipping liquid charged with copper through previous operations answer for objects having certain parts of iron, tin, antimony, bismuth or lead; in these special cases it is necessary to prepare a fresh, well diluted acid solution. Articles cleansed with potash should be well swilled before dipping, in fact, a good rinsing, in plenty of clean water, before and after every one of the following operations, cannot be too strongly recommended.

The various manipulations completing the cleaning process must follow each other without interruption, and the articles treated should be stirred as much as possible, both in the acid and rinsing bath. To give some idea of the importance which attaches to these operations, it may be stated that good results will be obtained even with an inferior gilding, silvering, or coppering solution, provided the cleansing has been well attended to, while the reverse will not hold good.

The articles, properly dipped and washed, are then fixed on copper rods or hooks by means of brass wire; articles of jewellery are generally strung upon copper wire. Red copper is preferable to brass for these hooks; but very careful manipulators use glass, which costs but little, is not attacked by acids, and therefore not likely to stain the articles suspended on them. Any operator can prepare these glass hooks by twisting suitable glass rods to the required shape over a strong batwing gas-flame. Very small objects are placed in baskets, or perforated bowls of stoneware, or gutta-percha, or in baskets of brass wire-cloth with the meshes more or less close. The latter are, of course, more expensive, but in some cases indispensable. Where small articles have to be handled often, it is well to have a platinum wire-cloth basket made, which although costly at first, will be found a great economy in the long run.

Dipping in Old Aquafortis.—If the operator has some aquafortis already weakened by previous dippings, he should immerse the articles which have passed through the sulphuric acid pickle bath in it, and leave them until the red coating of protoxide of copper has quite disappeared, so that the articles present after swilling an uniform metallic tint. This dipping in old aquafortis is not indispensable, but it is to be recommended as economizing new and more expensive acids, and because its slow action prevents too rapid corrosion of those parts already denuded of the protoxide. The reason why some workmen have burnt, pitted, corroded or granulated surfaces is simply because they neglect this operation and dip at once in new aquafortis. At the end of the first part of this work instructions will be given how to make the best use of aquafortis and other dipping baths which have become exhausted.

Dipping in New Aquafortis and Soot.—The articles withdrawn from the previous liquid must be thoroughly rinsed, shaken, and drained; and then immersed in the following bath:—

Nitric acid at 36° Beaumé (straw-coloured aquafortis) 100 parts in vol.,

Common salt 1 part.
Calcined soot 1 part.

This mixture acts most powerfully on the metals, they should therefore not be left in it more than a few seconds. The quantity of acid should be from twenty to thirty times in excess of the volume of the objects to be dipped, in order to prevent too great an elevation of temperature, due to chemical reaction, which would result in the rapid weakening of the acids. When taken from this bath the articles are rapidly swilled, to prevent nitrous vapours; and they will then generally display surfaces of a beautiful red lustre, gold or greenish yellow, according to the alloy used. The metal might now be thought quite free from impurity or foreign bodies; but such is not the case, and put in a gilding or silvering solution in this condition it will come out of it quite black and without any metallic lustre. Pieces taken out of the aquafortis and left in contact with the air without previous rinsing, produce a green froth and abundant orange yellow vapours on their surfaces, indications of the decomposition of the acids still clinging to them; and even after the vapours have disappeared the metal still looks black and tarnished, due to the formation of a basic copper salt, insoluble in water.

The last mentioned method, called blacking by aquafortis, is preferred by some gilders, and more especially by varnishers and colour fixers, being more economical; they allow the formation of nitrous vapours while the articles are draining on the top of the vessel containing the acids. Whichever mode is adopted, the work must be rinsed in clean water before proceeding to the next operation. Very small objects, such as pins, caps, eyelets, etc., are put in a stoneware pot with a small quantity of aquafortis, and then rapidly stirred and shaken. The acid employed in this case is completely consumed, passing off as vapour; the articles remain black and are thus ready for the next manipulation.

(*To be continued.*)

TRADE RECIPES, &c.

(*Continued from page* 117.)

To Distinguish Diamonds.—Mons. Rabinet, of the French Academy of Sciences, gives the following test for distinguishing colourless gems from diamonds. If a person looks through a transparent stone at any small object, such as the point of a needle, or a little hole in a card, and sees two small holes, the stone is not a diamond. All white colourless gems, with the exception of the diamond, make the object examined appear double; in other words, double refraction whenever exhibited by a stone, is conclusive proof that it is not a diamond.

Squaring up the Shoulder of a Main-Spring Hook.—A very useful little tool for squaring up the shoulder of a main-spring hook is easily made by drilling a hole the right size into the end of a piece of steel wire, which should be fitted into one of your chucks. After drilling the hole and facing it up, take a very thin saw and saw a slot right down the centre of the hole a short distance, then carefully file it up so as to leave two cutting edges, removing the metal in front of each cutting edge, which will give it the appearance of a carpenter's bit that has the point broken off, and a hole drilled where the point had been. When you have filed up the tit in the hook, put the cutter in the lathe and place the tit in the hole and press the shoulder up against the face of the cutter, and you can make a perfectly square shoulder in a few seconds.

Cleansing Silver.—The East Indian jewellers clean silver by briskly rubbing it with slices of a juicy lemon, and then covering the article with the slices in a pan for a few hours. They then swill them two or three times in water, stir them in nearly boiling soap-suds, brush, rinse, and finally dry them on a metal plate over hot water. Green tamarind stems are more powerfully detergent than lemons, and are employed to remove oxide and fire marks from gold and silver.—*Telegraphic Journal.*

Elsner states in the Chemical Society's Journal, that silver cleaned in water in which potatoes have been previously boiled, receives a superior polish.

Mons. Levol's Solution for Gilding Silver.—Dissolve neutral chloride of gold in water, then add an aqueous solution of sulpho-cyanide of potassium, until the precipitate first formed is re-dissolved. The liquid will retain a slightly acid reaction; if it has lost it, it must be renewed by adding a few drops of hydrochloric acid.

Mons. Becquerel's Gilding Liquid.—Dissolve one part of terchloride of gold and ten parts of ferro-cyanide of potassium in 100 parts of water; filter the liquid to remove the separated iron; add 100 parts of a saturated solution of ferro-cyanide of potassium, and dilute the mixture with once or twice its volume of water. In general, the tone of the gilding varies according as this solution is more or less diluted; the colour is most beautiful when the liquid is most dilute and most free from iron. To make the surface appear bright it is sufficient to wash the article in water acidulated with sulphuric acid, rubbing it gently with a piece of linen cloth.

Mons. De Ruolz recommends the following gilding solution.—Dissolve ten parts of cyanide of potassium in 100 parts of distilled water; filter the liquid and add one part of cyanide of gold, prepared with care, well washed, and dried out of the influence of light; keep the mixture in a closed glass vessel at the temperature of 60° to 77° Fahr. for two or three days, out of the presence of light, with frequent stirring.

The Welding of Metals at low Temperatures.—Some time ago, in order to estimate the amount of hydrocyanic acid in a solution, Mr. Charles A. Fawsett, of Glasgow, precipitated it with silver nitrate. After having filtered and washed the precipitate, he reduced it to the metallic state by heating to the required temperature. Just as he was about to allow it to cool, he noticed a small piece of dirt among the reduced silver. In order to separate them he took a thin platinum wire and pushed the silver to one side, but on attempting to take the wire away the silver remained in contact with it. As he thought this curious, he tried the following experiment: He took a piece of silver foil, about one centimetre square, placed it in an inverted porcelain crucible, lit and heated it to about 500° C., then he brought into contact with it the extremity of a thin platinum wire, and to his astonishment the wire raised the silver from the lid, and it remained in contact when cold.

The silver being so much below its melting point, its behaviour puzzled him, so he wrote to Sir W. Thomson for an explanation. On witnessing the experiment, Sir William pronounced it a remarkable case of "cohesion," the two metals, in fact, "welding," although the temperature was far below the melting point of silver. Mr. Fawsett says that the experiment can be performed successfully at lower temperatures than 500° C. if smaller pieces of foil are taken, and that other metals, for instance, copper and aluminium, cohere to silver in the same manner as platinum, but less strikingly. —*Scientific American.*

Tarnishing of Silver.—This change is occasioned by the sulphur of the sulphuretted hydrogen gas, a small quantity of which is always present in the atmosphere. This sulphur combines with an extremely thin coating of the external part of the silver, thus forming sulphuret of silver, a substance of a blackish-brown hue. The tarnish can only be removed by taking off the whole of the sulphuret so formed, and, therefore, a considerable portion of the actual silver of plated articles is destroyed in removing the tarnish. It is important to understand that tarnish is *not something added to the metal*, leaving it as before, *but the metal itself changed.* The thinnest coating of any substance, such as gum arabic, gelatine, or isinglass, will prevent the tarnishing by protecting the surface from the air. Silver ware which is put by should always be subjected to such a treatment.

(*To be continued*)

HINTS TO REPAIRERS.

(*Continued from page* 118.)

If a proper degree of care has been exercised, the barrel will now be ready for the mainspring; but first let us suppose the old barrel was in such a bad condition, so sprung or cracked, that it could not be remedied as before directed, in which case a new one must be supplied. If you can get one from the material dealer in time, of the proper size, it will save some work. To fit a new one, proceed the same as above described for an old one, after it is bushed. Always true it up by the outside, then you can get your hole concentric with the circumference of the barrel. Every one should have a Swiss gauge to get measurements by, as it will save much trouble and time. First get the outside the proper size, then bore out the hole nearly large enough for the pivot, then true up the inside with a graver or cutter; turn down the groove for the lid until it measures the same distance from the bottom of the outside of the barrel as the old one, premising that the old one was correct; turn down the shoulder to the same thickness as the old one. Before taking the barrel off the chuck, satisfy yourself that it is of the proper size and thickness, and that the shoulder for the lid is correct, and the end not too thick; then take it off and try it in the arbor, first having opened the hole with the round broach; try the height by putting it between the plates with the arbor in it; next fit the lid, which may be too thick and require to be turned, filed, or stoned down a little. Now drill a hole for the hook, and carefully file out a rectangular hole, which should not be drilled directly towards the centre of the barrel, but at about an angle of 45 degrees from the radius, so as to hold the hook when the mainspring is in; after which polish up the barrel and lid with oil-stone powder and oil, next with tripoli, and then with rouge, or Vienna lime. If you cannot obtain a barrel in time, and have to make one, select a piece of brass somewhat thicker than is required, and hammer it well so as to harden it, and close up the fibres of the metal; with a pair of dividers strike a circle the size of the intended barrel, after having made a good centre; then cut away the bulk of superfluous metal from the outside of the circle with a saw and file, then cement it into a brass plate that is perfectly true, and when cold put it up in the universal lathe, and if you have a hole in the centre of your plate large enough to let your pump centre come through, and your blank, with its centre down, is immediately over that hole, you can easily put it up true; make a new centre, and inscribe a circle in the now outside for a guide. Now drill a hole clear through the blank, a little smaller than the pivot that is to go into it, then turn out for the inside of the barrel, allowing for thickness of the rim from the circle. The Swiss gauge will come into use at this time in getting the thickness. Allow for your shoulder, and turn out the groove for the lid, and make the barrel the proper height; then turn up the outside, being careful not to go down to the brass plate until you have finished it, or you will jar the barrel off. In cementing the blank, or in fact anything, on to a plate or chuck, always rub the article about, using considerable pressure, so as to get as much of the shell acout from under it as possible before it cools. Now, if you have previously faced off the other side of the barrel, you are ready to drill for the mainspring hook, and then polish it up, and, if you are prepared to do so, gild it. It frequently happens that you can use the old lid when putting in a new barrel, which will save some work.

It is impossible to lay down any absolute rule as to the strength and length that a spring should be in any one of the various watches that come to us for repairs, unless we know the character and quality of the train and escapement, weight of balance, etc. Take two watches of the same caliper and same train as far as the number of teeth in the wheels and pinions are concerned, but of far different finish, and the shape of the teeth of one as near perfect as possible, and of the other as imperfect as they could well be made. Now, one of these watches will go with a weak spring, whereas the other requires a very strong one, especially if the escapement is bad, which is usually the case when the train is not properly constructed; but to be safe, always use as weak a spring as possible, that will be certain to drive the watch, and give the balance a good motion. Another important fact connected with mainsprings, and that every one should know, is this: a wide thin spring gives better and more constant results, besides being less liable to break, than a narrow thick one. Always use as wide a spring as the barrel will take, and as thin as will drive the particular watch you may have in hand; furthermore, there should always be one full turn more of the spring in the barrel than is actually used, and in very fine watches we frequently see two. If the old spring was right, select one of the same width and strength. A pivot gauge should always be used to get the strength, and not depend on springing it with your fingers to test its strength. By careful observation you will soon learn to select a spring with but little trouble. You may have to change a few springs on account of their strength after putting them in, but if you do, that will teach you more than twenty pages of printed directions. After having selected the spring that you intend to put in, break it off full long, try it in, and if on a radical line the space occupied by the spring equals the open space between the spring and the arbor, then the spring is of the right length, provided the strength is correct. Take it out and heat it with the alcohol lamp from the end to half an inch back, but do not heat it red hot, but remove it from the flame when it is black; punch a round hole one-fourth of an inch from the end, then put the spring in the bench vice, so that one-third of the end of the spring projects above the jaws of the vice and opposite where the hole is, letting it come even with the top of the vice; file the exposed part away, turn it over, and serve the other edge the same way, which will leave the spring one-third its original width at the end, and the full width opposite the holes; then thin the end down with a file to one-half its original thickness, but do not file the inside of the spring away; countersink the hole slightly, when it will be ready for the hook.

If the hole in the barrel is rectangular, select a piece of flat steel wire as near the size as possible (if a round hole, take round wire); file it down so as to fit the hole perfectly free, then put it in the pin vice, letting it project about one-sixteenth of an inch, and instead of putting it straight through the jaws of the vice as you do pin wire to make pins, deflect it to an angle of about 45 degrees; now hold the vice the same as you would to make a pin, and file up a tit in the end of the steel wire, making a square shoulder with the jaws of the pin vice for your guide; examine it with a glass, and see if you have got a good shoulder. Where the tit meets the hook it should be towards the front of the hook, so that the bulk of the metal will project back of the tit, which renders it more secure and less liable to pull out. Now, when you have got the tit well fitted into the spring, and a good shoulder to it, take it out of the pin vice and fasten it in the bench vice, so that the shoulder projects slightly above the jaws; put the spring in, and rivet it fast; cut off the wire, leaving enough attached to the spring to make the hook; see if the hook fits the hole in the barrel; put it through from the outside, and mark on the inside where it comes through; then file down to that mark, making the end of the hook of the same curvature as the barrel; stone it to get the file marks out, then burnish it; clean it and the barrel, and put it in with the winder. If the hook projects at all, take it out and file away as much as will be necessary to bring it down flush. Never file it when it is in the barrel, as that will disfigure the barrel; clean and put it in again, oil it, put in the arbor, put on the lid, and oil the arbor pivots, and with a pair of hand-tongs wind the spring up full, to see if it will stand, which also distributes the oil that is on the spring. The spring and barrel are now ready for the watch.

(*To be continued.*)

FOREIGN COMPETITION.

On the occasion of the Twenty-sixth Anniversary Festival of the London Association of Foremen Engineers and Draughtsmen held at the Cannon-street Hotel, on the 15th ult., Mr. W. H. Bailey, C.E., of Salford, in responding to the toast the "Engineering Employers in Town and Country," made some practical remarks on the present stagnation of trade. Mr. Bailey said:—

"It was proper that we should, with all humility, with all care, and with a proper scientific spirit, inquire into the causes of our want of prosperity. It might do us some good to do it with a melancholy spirit, but that to him was a matter of doubt; but we have been grovelling and debasing ourselves. We have lain down in the gutter and requested to be kicked; we told the foreigner at our meetings, through the press, in the senate, and at the street corners, that we were being beaten; that the imperial pride of Englishmen to be considered the manufacturers and merchants of the world was decaying; that our glory had departed from us. This was advertising ourselves in a most improper manner, for we clearly told all foreigners to go to the United States, and to any other foreign country for goods, because they could be bought cheaper and better there than here. It was stupidity so profound that it became almost grotesque if it were not for the painful side of the subject; and that was that it was untrue, its only result being to aggravate the disorder.

"All sorts and manners of men not engaged in trade, ventured an opinion; members of Parliament and Prelates had given advice, which should be accepted at its value, just as coals from a particular pit have a value (laughter); but so much has been said about United States' competition, that a few words may be useful. In 1876 we exported from England of manufactured iron to the value of £19,000,000 sterling. The American exports for the same period came to £1,000,000. The exports of machinery such as agricultural, mowing, sewing and other machines of this country, came to £7,600,000, those from America came to £1,500,000. Some time ago all the sewing machines used in Europe, indeed in the whole world, were made in the United States, they sold at high prices, but during the past few years the trade in sewing machines of the United States manufacturer had rapidly decreased in this country. It is as well known that for a long time the machine that was sold retail in New York at £8 was sold retail in the shops of Liverpool at £6, both machines being made at one works in America. This lowering on price was the result of English competition. At last the competition became unbearable, and what did the chief sewing machine makers do? They acted like wise men, and built factories in Glasgow, in Coventry, in Manchester, and came here to employ Englishmen, for that was the only way they knew of to meet the tide of English competition. Howe established a works, so did Singer, and others have followed. (Loud cheers.) I venture to make this assertion, that in the boot and shoe manufacturing districts of England, Bristol, Northampton, Stafford, and at Leicester, the machines made by Englishmen, and sold at English prices, are the only machines that are being bought. (Cheers.)

"Mr. Chairman, my lord and gentlemen, I am afraid I tire you (said Mr. Bailey). (Cries of 'Go on.') The speaker then said that he might be permitted to say a word or two about other goods that were being sent in small quantities. A great deal had been said about American padlocks. They were not as cheap as an English lock; they were no better made; and it was simply American ingenuity displayed, in getting our papers here to advertise their wares without payment. Trinkets, and small articles, that could be carried in the waistcoat pocket were being made by the effeminate nations in competition with us. (Loud laughter.) But if the present stagnation continued, our Birmingham and Sheffield men would stop the 'stereotyped edition,' and arrange tools that would soon prevent the slightest competition, even in those small things. When our workshops were so full, four years ago, that engines, tools, and machines could not be got for love or money, foreign nations began to compete, and Mr. Bailey said he sent to Boston and Philadelphia even for lathes and chucks, and slide rests; but at what cost? At fully thirty per cent. more than they can be purchased at in this country. Pumps of American make were being sold some time ago at 20s. and 25s. each, but that has stopped, for you can get them now at 15s. and 12s. 6d. each; and if anyone will order a dozen, they shall have twenty-five per cent. discount, and two-and-a-half per cent. for cash in a month, and these are heavier and better made than the flimsy things from the other side of the water. (Cheers.) About our textile manufactures, much has been said. Well, if we put together all the Americans send abroad, add up all things made from fibre, all things with weft or warp, everything having longitudinal and latitudinal meshes, everything with tissues, composed of either animal or vegetable growth, all those things, from a yard of calico to a door mat, add them all together, and a cotton-mill can be found where I come from in Salford, that produces more in value than the United States export in the year. (Cheers.) So much for competition in that direction. Then let us turn to our iron manufacturers, who cannot be accused of lethargy; but they can be accused of having a disinclination to deal in half-ounces of iron, they can be accused of a wish to do their business in a wholesale manner; and when they have been busy on fixed patterns they have felt disinclined to alter their rolls and their methods of manufacture for an order even for the whole iron in a Town-hall or for all the girders of an Exchange (hear, hear); and even when trade is bad, certain patterns, produced to special conditions, may be had cheaper from one place than another; and very often in these little orders those who keep the worst set of books get the order and execute and pay for the material in the bankruptcy courts. (Laughter.) We have heard of Belgian competition; we have heard of orders for girders being executed at one shilling a ton below ours; but what about the balance sheets of those firms who have so acted? (Hear, hear.) On the Manchester Exchange printed calicoes have been offered at low prices and of a quality, design, and colour, that, according to Ruskinite taste, would only please those men whose instincts were sanguinary, and whose tastes were either undeveloped or deformed; these were offered at low rates by American brokers, but further supplies could not be got at the same prices, for reasons which will be seen. There is not the monotony of uniformity in a pawnshop (roars of laughter), which may be found in a Manchester soft goods warehouse. This country is the birth place of leisure. Man can think only when the body has rest. There never was rest until Englishmen created it by placing in bondage the great black slave, the steam engine. Thus has the mind endowed the body, and thus, if we are sincere, shall we benefit still further the whole human race;

> 'For I doubt not through the ages one increasing purpose runs,
> And the thoughts of men are widened by the progress of the suns.'"

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from page* 120.)

CLOCKS have been applied to other purposes than the mere simple measurement of time. George Graham applied the movement of a clock, showing sidereal time, to make a telescope point in the direction of any particular star, even when below the horizon. In Greenwich Observatory was set up a curious transit clock, made by Graham, but greatly improved by Earnshaw, who so simplified the train as to exclude two or three wheels, and also added cross braces to the gridiron pendulum, by which an error of a second per day, arising from its sudden starts, was corrected. Sidereal time, or star time, is that which is obtained by the observation of the transit of stars over the meridian, and, as it depends upon the rotary motion of the earth alone, and is influenced by the irregularities of orbital motion, it is subject to no variation, and is consequently most uniform. But there is a considerable difference between solar and sidereal time, the sidereal day being four minutes shorter than the solar day.

In the "Philosophical Transactions" of 1726 is an account of a contrivance to avoid the irregularities in a clock's motion, occasioned by the actions of heat and cold on the pendulum rod, by George Graham.

In 1727, William Hogarth published a satirical print called the "Masquerade Ticket," on the top of which was a clock, that is thus described in John Ireland's "Hogarth Illustrated": "The head of the renowned Heidegger, master of the mysteries and manager in chief, is placed on the front of a large dial, fixed, lozenge fashion, at the top of the print, and, I believe, intended to vibrate with the pendulum, the ball of which hangs beneath, and is labelled 'Nonsense.' On the minute finger is written 'Impertinence,' and on the hour hand 'Wit;' which seems to intimate, nonsense every second, impertinence every minute, and wit only once an hour! The time is half-past one—the witching hour of night. Seventeen hundred and twenty-seven, the date of the year this print was published, is on the corners of the clock. Recumbent on the upper line of the print, and resting against the sides of the dial, the artist has placed our British lion and unicorn renversé (such, I think, is the term in Heraldry), lying on their backs, and each of them playing with his own tail. The lion sinister, and the unicorn dexter, the supporters of our royal arms, being thus ludicrously introduced, may, perhaps, allude to the encouragement King George the Second gave to Heidegger, who at that period might be said to 'teach kings to fiddle, and make senates dance,' who, by thus kindly superintending the pleasures of our nobles, gained an income of £5,000 a year, and, as he frequently boasted, laid out the whole in this country. Under the clock, Hogarth delineated the scene of a masquerade."

In 1730 appeared the following advertisement of a clock-lamp: "Walker's new invented Clock-Lamp, which not only far exceeds any Lamp hitherto invented, both as to its Neatness in the using (it neither daubing the Fingers at all in the Dressing, nor making any Daub where it stands, as others do) as well as in the clear continued Light it gives from the first lighting of it till all the Oil is quite spent, without so much as once snuffing it the whole Time; but it likewise shows the Hours of the Night exactly as they pass, from the Time of going to Bed till the next Morning; or, from the Time of lighting the Lamp till it is quite burnt out, supplying, at once, the Place of a Clock or Watch and Candle, when used with proper Oil, which is sold with the Lamps, wherein it is entirely, and beyond all others; and, being conveniently placed by the Bedside, one may lie still in Bed and see how the Time passes. Sold only by John Walker, removed from Fleet Street to the 'White Horse and Bell,' near Cheapside Conduit; where is also sold all sorts of Braziers' and Ironmongers' Goods and the newest fashion'd French Plate very cheap, he being the Maker." This artist appears to have had a formidable rival in trade; for we find the following advertisement appearing in 1731: "Ashburne's New Invented Clock-lamp, shewing the Hours of the Night, exactly as they pass, far exceeding anything of this kind ever yet invented. To be sold Wholesale or Retale by the Inventor and Maker, Leonard Ashburne, at the 'Sugar Loaf' in Pater Noster Row, next Cheapside; at Mr. Cole's, at the 'Rainbow and Dove' in Chancery Lane, next Fleet Street; at Mr. Noon's, at the 'White Hart' in the Poultry; at Garraway's Old Shop, the South entrance of the Royal Exchange; and at Mr. Taylor's, a China Shop, over against St. Alban's Street in Pall Mall. Where likewise are Sold, All Sort of Chamber Lamps, in the greatest Variety, which have given the Publick a general Satisfaction. With Oil fit for the Purpose. Whereas a malicious and ill designing Advertisement was set forth by the Lamp Pretender in Cheapside in the 'Craftsman' of Saturday last, and in the 'Daily Post' of Wednesday, the 6th inst., wherein he calls those Lamps sold in Pater Noster Row counterfeit, &c., which any Person in View will find to be false and malicious, endeavouring thereby to lessen the Character and Reputation which they have gain'd beyond all others, notwithstanding his imposing on the Publick, as being the Maker, and now within this week styles himself the Inventor, when he knows as do many others, that they were made long before he was concerned in them. And as for counterfeiting them, I desire that all persons that shall have any Occasion, will do themselves the Justice to see both sorts, before they will be imposed on by such a base and ill designing person." At the top of this advertisement is a rude woodcut, representing four lamps; one of which is somewhat like a coffee-pot in shape; the others are formed like vases; and in all, the part which holds the wick projects from the side of the lamp.

During the eighteenth century musical and automaton clocks were much in fashion. In addition to those we have before referred to, we may mention the following. In Bagford's Collections, Harl. MSS., 5946, in the British Museum, is this advertisement: "The celebrated musical clock, approved of by the greatest quality in this Kingdom, which, besides divers curious motions, performs, 1.—A Consort of Italian and English music, either single, or in parts, to the number of 32 different tunes, including sets of airs, minuets, jiggs, borees, sarabands, comants, &c., on organs, trumpets, flutes, and flagellets, very true and melodious. It shifts a fresh tune of itself, and repeats at pleasure. 2.—In the course of this harmony the seven liberal sciences, viz., Musick, Optick, Physick, Architecture, Painting, Mathematicks, and Eloquence, appear, each with some proper instrument to denote her profession. 3.—Apollo breaks through a cloud with his harp in his hand. 4—A cuckoo calls, and 17 small birds warble their proper notes as natural as if living. Its model is exact and regular, and adorned with a vast number of curious carved and gilded figures, with the Queen under a triumphal arch, the pedestal the same as at St. Paul's, and many other curiosities. To be seen at the 'Duke of Marlborough's Head' in Fleet Street, from nine in the morning till eight at night. To be sold for 700 guineas, or raffled for at five guineas per ticket." The King of Spain, before the French Revolution, had a clock, which played one hundred tunes loudly like a full band. The bottom part was a large stand; above on a pedestal were three ormolu figures, about four feet high; on the top was a large globe representing the earth, which moved so as to display the diurnal and also the annual motion of the world. This clock came into the possession of a Madame Beauzalic, of Paris, who asked a very large price for it. There is a musical clock at Knole, Kent, with a bird at the top of it, which sings and flaps its wings.

(*To be continued.*)

ON THE COMPENSATION OF CLOCKS, WATCHES AND CHRONOMETERS.

By Edward Rigg, M.A.,
Assayer in the Royal Mint.

We reproduce a very interesting and instructive paper on the intricate subject of compensation, read on the 12th ult. at the Society of Arts, by Mr. Edward Rigg, M.A., whose name has become favourably known in horological circles as one of the translators of Saunier's "Treatise on Modern Horology." The lecture was successfully illustrated by large maps, representing various compensating pendulums and balances; also by several ingenious experiments and a collection of compensation balances. The lecture, evidently the result of much patient research, is very valuable, as it represents, in a condensed and comprehensible form, what has been achieved in this most important branch of horology in this and other watch and clock-making countries. We need hardly point out the great utility of such a compilation to inventors. Any one at all acquainted with the proceedings at the Patent Offices, knows that numerous applications are brought there which turn out to be simply repetitions of ideas already in practice, or of still older ones abandoned long ago. Years of hard work and vast sums of money are thus thrown away, a fact which points out the necessity of acquainting ourselves with what has actually been accomplished in the science we pursue. Mr. Rigg has given us a clear *resumé* of what has been done for the compensation of timekeepers, and we feel sure that it will do much good service:—

"With very few exceptions, the mechanical arrangements used for the measurement of time are regulated by a more or less heavy body, oscillating in a circular path round a centre of motion. In stationary clocks, this control is obtained by means of a pendulum, under the influence of gravity; and, in portable timekeepers, by a balance, independent of the directive action of gravity, but subject to that of a delicate spring.

The motion of the train of wheels being solely determined by the release of a tooth of the escape-wheel through the motion of this regulator, it will be evident that each of its oscillations must be performed in the same period of time, in order that the hands may continue to travel with constant velocities. Various circumstances, however, tend to prevent our attaining this absolute uniformity, and any device introduced into a timekeeper, supplementing the mere mechanism required to maintain the motion of the regulator, or the application of any principle in such a manner as to make the uniformity more perfect, must be included under the term "compensation." The subject, then, has a very wide significance, and it would be impossible, in a single paper, to profitably discuss the several phenomena that interfere with the going of a timekeeper; but it may be well to draw attention to the following table, which gives the influences that are of primary and secondary importance in two separate classes.

Class I.

1. Motive force.
2. Isochronism.
3. Heat.

Class II.

1. Atmospheric pressure.
2. Electricity and magnetism.
3. Hygrometry.
4. Gradual acceleration (in chronometers).
5. Gravity.

It is only intended to consider the third in Class I. (Heat), and the first in Class II. (Atmospheric pressure), with any degree of completeness, but a few words on the other points may not be out of place.

The well-known fusee and chain of the English watch and the chronometer, and the very great variety of constant force or *remontoire* escapements, were introduced to neutralise the want of uniformity in the force exerted by a coiled spring; but the opinion is now held by many, that in watches intended for ordinary use, where very great accuracy is not needed, the force, although far from uniform, will give satisfactory results, if the spring be so proportioned to its barrel that it requires about four turns of the key for complete winding up, only three of which are ever called into action for the purpose of impelling the train. In frictional rest escapements, such as the horizontal, the resistance to the motion of the balance, owing to the pressure of the tooth, increases as the motive force increases, and in this way the mechanism itself compensates, approximately, for any variation in the force.

Strictly speaking, of course, isochronism should include the entire subject of compensation; for all that we require is to cause each oscillation to occupy the same period of time; but the term is exclusively used to refer to that fundamental condition, in virtue of which the duration of an oscillation of the regulator is entirely independent of the amplitude of the arc described. A pendulum requires to move on a cycloidal curve for its oscillations to be isochronal, and, if its path is circular, the long arcs occupy a longer period. The experiments of Winnerl and Laugier prove that the length and thickness of the suspension spring and the weight of the bob may be so correlated as to give isochronal motion; and Dr. Hipp points out that the escapement, suspension spring, etc., may have a like action. A method of isochronising the motion of a pendulum was exhibited by Loseby at the Exhibition of 1851, but it was not found to be successful when tried. The length of the balance-spring of a chronometer or watch may be so adjusted that the force of its elasticity is exactly proportional to the angle through which the balance is turned; when this is the case, the vibrations of the balance will be isochronal. This point is generally found at about the eighth coil in a cylindrical spring, and the twelfth coil when the spring is a flat spiral; with a greater length the balance will lose in the long arcs as compared with the short arcs, and with a less length the reverse is the case.

Very little is positively known as to the precise nature of the action exerted by electricity and magnetism on chronometers. Experiments were made by Fisher and Barlow in 1820, by Harvey in 1824, by Arnold and Dent in 1833, and others. A remarkable change in the rate is at times observed on transferring a chronometer from the Observatory on board ship, and this has generally been regarded as due to the magnetism of the vessel; Delamarche and Ploix, however, satisfied themselves experimentally that this cause was not sufficient to account for so great a change. When the atmosphere is charged with electricity, the chronometer is known to vary in sympathy with the magnetic needle, generally causing an acceleration in the rate. The same is the case in magnetic storms.

When a deal pendulum rod that has not beenproperly prepared is employed, it will expand, in a damp atmosphere, through the absorption of moisture; and the clock, therefore, lose on its rate. In chronometers, damp air is detrimental, in that it gives rise to oxidation of the highly-polished surfaces. Dent believed that the oxide thus formed on the surface of the balance-spring increases its elastic force, and thus occasions the remarkable acceleration that is observed to occur in the rate of a chronometer after it has gone for some time, an acceleration that at times amounts to as much as four or five seconds a day after two years. M. Robert, however, considers the thickening of oil a more probable cause. C. Frodsham considered it to be caused by a change in the molecular state of the spring, but Villarceau has shown that, under certain conditions, it may be occasioned by resistance at the balance pivots, thus confirming M. Robert's view.

Finally, the difference in the value of terrestrial gravity at various points on the earth's surface causes a corresponding change in the rate of pendulum clocks, but is without influence on timekeepers that are controlled by a balance. For the formula for the period of an oscillation of a pendulum shows that it depends, other things being equal, inversely on the square root of the value of gravity as usually measured; so that an increase of this force, in geometrical progression, causes the rate of the clock to increase arithmetically. Under this heading may also be included the variation in the centrifugal force due to the earth's rotation, which is zero at the poles, gradually increasing to a maximum at the equator; but it is very rarely that such influences as these need be regarded.

Compensation for Thermometric Variation.

It must not be assumed that what is known as a compensation pendulum or balance can be applied with advantage to any form of clock or watch. In either case, rapid manufacture and low price may render unavoidable faults of construction, that give rise to greater variations in the rate than are caused by temperature; and any form of compensation that is not accurately adjusted and well suited to the train, may occasion greater irregularity than would be experienced on replacing it by a pendulum or balance of ordinary construction. A change of temperature will influence the rate of a clock in two ways, only one of which sources of irregularity can be corrected efficiently by means of a compensation pendulum. It will produce a change in the acting surfaces through variation in the consistency of oil, &c., and it will alter the length of the pendulum. A reduction of the temperature below zero, as well as excessive heat, has a very detrimental effect on the oil, and, with a plain steel pendulum, the mere change in its length will only cause a variation of 0·53 second in 24 hours for each degree Centigrade rise or fall of temperature (or 0·3 second, using Fahrenheit's scale). It follows that an uncompensated steel pendulum, that is correct in spring temperature, will only lose through expansion 1′ in the hottest fortnight of summer, and gain a similar amount in winter.

Escapements may be divided into two classes, frictional rest and detached escapements. In the first, such as the verge and horizontal escapements in watches, or the Graham escapement in clocks, the pendulum or balance is never free from the mechanism by which it is driven; but in the second class, of which the lever escapement in watches may be taken as an example, the pendulum or balance only engages with the train long enough for the impulse to be applied. Now, all the acting surfaces must be supplied with oil, and, as the consistency of this is modified by temperature, a varying resistance is opposed to the motion of the balance when a frictional rest escapement is employed. The irregularity which this variation gives rise to in the rate is commensurate with that caused by expansion due to the change of temperature, and it evidently cannot be permanently counteracted by any system of compensation, since it depends on the age of the oil, &c. This disturbing influence has the greatest weight in watches; it is of sufficient importance to render compensation balances useless, and they are, therefore, never employed with this class of escapement. Moreover, such watches possess a kind of natural compensation of their own, for, as will be presently seen, the tendency of a watch is to gain in cold weather, and at the same time the oil will become thicker, and offer an increased resistance to the motion of the balance. The converse will be the case in warm weather. Clocks with undetached escapements are also subject to this influence, but in a less degree.

The conditions of the problem of compensation in clocks regulated by a pendulum, are so entirely different from those met with in timekeepers that are regulated by a balance and balance-spring, that it will be necessary to consider the two cases separately. We will begin with the more simple case of the pendulum.

The well-known formula for the time of oscillation of a simple pendulum[*] shows that this period varies with the square root of the length, and calculation shows that an increase of $\frac{1}{720}$th the initial length causes a loss of one minute in twenty-four hours. From such data it is easy to determine the effect of a given rise or fall of temperature, if the material of which the pendulum rod is composed be known. It is only necessary to multiply together the coefficient of linear expansion per degree, the number of degrees change of temperature, and 720, to obtain the alteration per 24 hours in minutes. Thus for a rise of 20° Centigrade (36° Fahr.) with a steel pendulum rod, for which the coefficient of expansion per 1° Centigrade is 0·0000124, the clock will lose 10·7 seconds on its daily rate.

The most obvious mode of diminishing the sensibility of the pendulum to variations of temperature is to employ a material for the rod that is but little influenced by such changes. Glass and wood have been suggested, but the former is objectionable on account of its fragility. Very good results may be obtained with a carefully made wooden pendulum, and well seasoned deal is usually employed, but M. Winnerl, of Paris, recommends the wood used for the sounding boards of pianos as the best. In any case, it must be straight-grained and without faults, and it is advisable to make the bob cylindrical instead of lenticular, since the rod is liable to twist through torsion. The principal objection to the wooden pendulum, however, lies in its sensitiveness to variations in the hygrometric state of the atmosphere. In 1834, Baron de Prony made experiments on varnished and unvarnished deal rods, to determine the effect of moisture, and he found, with the hygrometer at 70° (saturation being 100°) that the varnished rod showed a loss of only 1·07 sec. in twenty-four hours, as compared with its rate in dry air; whereas the elongation of the unvarnished wood occasioned a loss of 2·98 sec. M. H. Robert, a celebrated French clockmaker, soaked the wood in a drying oil after having thoroughly seasoned it; the wood was then left to dry and was varnished; he also avoided the effects of moisture by enclosing the rod in a brass box. Kater mentions that a gilded teak rod is unaffected by moisture; and, finally, Sir E. Beckett proposed that the rods should be subjected to a creosoting process.

It is unquestionable that a carefully made wooden pendulum is to be preferred in all clocks, other than the very best astronomical clocks; in conjunction with a well-made train, it can be relied on to give a more uniform rate than any unadjusted compensation pendulum; indeed, such a pendulum may give rise to very great irregularity if, as is perfectly possible, the arrangements for compensation tend to produce an opposite effect to that which is required.

An immense variety of devices have been proposed for correcting this error of temperature, but they may be classified under four heads:—

1. Two or more solid and rigid substances employed in

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[*] $t = \pi \sqrt{\frac{l}{g}}$ where l is the length of the pendulum, g the value of gravity (32·2), and π the ratio of the circumference to the diameter of a circle. If two pendulums of lengths l and l^1 differ to the extent of one minute in twenty-four hours, it may be shown that $\sqrt{\frac{l^1}{l}} = \frac{86400+60}{86400}$, and hence we obtain $\frac{l^1-l}{l} = \frac{1}{720}$ very approximately.

conjunction, and so arranged that the vertical downward expansion of one is neutralised by the vertical upward expansion of another.

2. Two metals of different expansibilities actuating levers, and thus maintaining the length of the pendulum invariable.

3. Two metals of different expansibility, rigidly joined together by soldering or otherwise, employed to vary the distance of a weight from the centre of suspension whenever the temperature varies.

4. Pendulums in which mercury is employed.

Before referring to examples of these classes, it will be well to explain the exact nature of the problem under consideration. The ideal, or "simple" pendulum of the mathematician consists of a heavy particle of no dimensions, connected with the centre of suspension by an inflexible string without weight; and, in order that its vibrations may be described in equal times, the arcs traversed must be very small, and the length of the pendulum must be invariable. Of course such a pendulum cannot exist in practice, but it is possible to calculate, for any actual pendulum, what would be the length of the simple pendulum, satisfying the above conditions, to which it corresponds. Thus, if $a\ b$ be the total length of a pendulum the period of whose oscillation is t, and $a\ c$ be the length of a simple pendulum that oscillates in the same time, $a\ c$ is the simple pendulum corresponding to $a\ b$. The point a is termed the centre of suspension, and c is the centre of oscillation. The one necessary and sufficient condition to be satisfied by the compensated pendulum is that this length $a\ c$ remain invariable.

The earliest design of pendulum of the first-class is the well-known "gridiron" of Harrison. It was invented in 1722, by Graham, but he soon abandoned the form in favour of mercury compensation, and the system was perfected by Harrison. It consists of a heavy bob suspended by nine vertical rods, five of these being of steel and four of brass.

A pendulum required to vibrate seconds must be of such a length as to make the distance between the centres of suspension and oscillation 39·14 in.; and it must further satisfy the condition here indicated, namely, the expansion of steel downwards must equal that of brass upwards. The coefficients of expansion of steel and brass are respectively 0·0000124 and 0·0000188 per 1° Centigrade, and it can easily be shown that the smallest number of rods that can satisfy this condition, keeping the pendulum symmetrical, is 9.* The arrangement of the rods and the mode in which they effect the required object is evident from the diagram. The two outer steel rods are firmly pinned at right angles to the upper brass cross-piece, but they are only held loosely by the pins in the lowest cross-bar. This carries two brass rods expanding upwards, and each pair is loosely held by pins in the same way. The innermost steel rod hangs from a pin at its upper end, passes freely through the lower cross-pieces, and supports the pendulum bob by a nut at its extremity.

The necessity for so many rods has always been regarded as a serious objection to this form of pendulum, and many attempts have been made to avoid the difficulty. Troughton suggested an arrangement, in which the four brass rods are replaced by two brass tubes, the five steel rods being joined in a manner corresponding to that above indicated. The bulk of the pendulum rod is thus diminished to a tube 0·6 in. in diameter, an important point, since the centre of oscillation is thereby lowered, and a shorter pendulum can be employed. As already noticed, zinc has a much higher expansibility than brass, and attention was, therefore, directed towards the employment of this metal. By increasing the length of the pendulum, and placing the bob some distance above the lower end of the pendulum, as shown in the diagram on the wall, supported by a short cylinder of zinc, Berthoud succeeded in obtaining sufficient compensation with only two brass rods and three of steel; and, even with a brass cylinder in place of the zinc, the compensation was at times found to be complete. This is a compact form of gridiron pendulum, but the excessive friction between the rods is a serious objection. Berthoud constructed them about 13 in. long, beating half seconds, and the centre of oscillation comes very near the centre of the bob if the proportions given in the diagram are observed.

Reid, Tiede, Jacob, Ward, Dent, and others invented pendulums in which zinc and steel are employed in conjunction; and in an interesting arrangement suggested long ago by Robert, zinc is associated with platinum as being at the opposite end of the scale of expansibility. The form adopted by Jacob is worthy of notice on account of its extreme facility of adjustment. The centre rod is of steel, and terminates in a screw bearing a locking-nut, which supports the rectangular zinc frame. A screw thread is cut on the upper portion of this, and a nut on it supports the frame that carries the bob. Assuming the pendulum to be under or over-compensated, it will only be necessary to elevate the upper screw and depress the lower one, or *vice versâ*, and the effective length of the zinc will thus be altered as required. The expansion of zinc being more than double that of steel, a single zinc rod less than the length of the pendulum will suffice for the compensation.

The only other combination of these two metals that need be specially referred to is the pendulum employed by Messrs. Dent and Co., for their astronomical clocks, in which the bob is of lead, and the steel and zinc are two concentric tubes, the rod also being of steel. A zinc tube resting on the rating nut supports, at its upper end, a steel tube by which it is enclosed; to the lower end of the steel is fixed, by its centre, the lead bob covered with a brass jacket. Holes are drilled through the steel and zinc tubes in such a manner that each portion of the pendulum is equally influenced by thermometric variation.

The pendulum by M. Robert, above referred to, is described in the "Bulletin de la Société d'Encouragement" (xxviii. 56) for 1829. A light platinum tube passes through a zinc bob, and terminates in a steel screw, which carries the rating nut. The bob extends to half the height of the rod, and its upward expansion is sufficient to neutralise the downward expansion of this latter.

(*To be continued.*)

Horology at Elementary Schools.—Among the Russian educational exhibits in Paris, was an enlarged model of a clock for the use of elementary schools. The model is so constructed that it can easily be taken to pieces and set up again, while it clearly demonstrates every action of our ordinary pendulum clock. The idea is very good and might be extended so as to clear up that mystery which the mechanism of clocks and watches presents to the ordinary public. Such instruction would not fail to bear good fruit in course of time, and render some of the barefaced frauds, which so injuriously affect our horological industry, less easy of accomplishment. Teach the purchaser to distinguish a good watch from a bad one, and the honest manufacturer will soon have fair play.

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* For, let n be the number of downward expanding steel rods, and n' the number of upward expanding brass rods, and assume them to be approximately of equal lengths; we have

$$\frac{n}{n'} = \frac{\text{co-efficient of expansion of brass}}{\text{,, \quad ,, \quad steel}} = \frac{0.0000188}{0{\cdot}0000124} = \frac{3}{2}$$

very nearly. There are then 5 rods required theoretically, and 4 additional ones are needed in practice, to give rigidity and symmetry to the pendulum.

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PATENTS.

Applications for Letters Patent.

933. Etienne Mathurin Léon Maxant, of the city of Paris, in the republic of France, for an invention of "Improvements in invisible clockwinding mechanism with permanently located keys."—Dated 10th March, 1879.

1246. Clara Milton, of South Audley Street, in the county of Middlesex, for an invention of "Improvements in thermometers."—A communication to her from abroad by David Winstanley, of Paris, in the republic of France.—Dated 28th March, 1879.

Patents Sealed.

3766. Martin Lowenstein, of Birmingham, in the county of Warwick, Manufacturing Jeweller, for an invention of "Improvements in buttons, solitaires, sleeve-links, studs, and other dress fastenings and ornaments."—Dated 24th September, 1878.

3595. Joseph Clark, of Liverpool, in the county of Lancaster, for an invention of "An improved safety fastening for studs, buttons, brooches, and analogous articles."—Dated 11th September, 1878.

3409. William Merchant, of 5, Southampton Buildings, in the county of Middlesex, for an invention of "Improvements in the fasteners for brooches, shawl-pins, and other articles."—Dated 29th August, 1878.—[Extented to 11th March, 1879.]

269. Farnham Maxwell Lyte, of the Scientific Club, Savile Row, in the county of Middlesex, for an invention of "An improved mode of operating in the separation of all or either of the metals, lead, zinc, silver, or copper, in mixed ores or metallic mixtures, by means of acids, brine, and certain other re-agents."—Dated 22nd January, 1879.

Notices to Proceed.

4241. Henry Garner Pendleton, of 11, Chain Walk, Lozells, Birmingham, Jeweller, has given notice in respect of the invention of "Improvements in buckles."

4674. Auguste Lion, Jeweller, of the City of Paris, in the republic of France, has given notice in respect of the invention of "Improvements in bracelets, necklets, and chains, and in their mode of manufacture."

Patents which have become Void.

760. William Robert Lake, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, for an invention of "An improved machine for cutting diamonds and other precious stones."—A communication to him from abroad by Henry Daws Stover, of the city and state of New York, United States of America.—Dated 23rd February, 1876.

839. John George Henry Hoch, of 283, Brixton Road, Brixton, in the county of Surrey, Watch and Clock Manufacturer, for an invention of "An improved system of public and other clocks."—Dated 29th February, 1876.

956. Thomas William Greaves, Jeweller, of Birmingham, in the county of Warwick, for an invention of "Improvements in ornamenting solitaires and other artioles of jewellery with pressed glass, and which said improvements are also applicable for other useful purposes."—Dated 6th March, 1876.

1051. Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for an invention of "Improvements in compensation balances for marine and other chronometers."—A communication to him from abroad by Joseph Thadæus Winnerl, of Paris, France.—Dated 10th March, 1876.

1091. Edwin Powley Alexander, of 14, Southampton Buildings, in the county of Middlesex, Consulting Engineer and Patent Agent, for an invention of "Improvements in pocket alarums or alarm watches."—A communication to him from abroad by Charles Frédéric Dietz-Monnin, of the firm of Tapy Brothers and Company, of Paris, in the republic of France, Manufacturers.—Dated 13th March, 1876.

Grants of Provisional Protection for Six Months.

739. To Charles Owen Rogers, of Aldermanbury, in the city of London, Manufacturer, for the invention of "Improvements in scarf rings or scarf slides for fastening scarfs and other articles of dress."

878. To Frederick Arthur Walton, of Birmingham, in the county of Warwick, Manufacturing Jeweller, for the invention of "Improvements in scarf rings or scarf slides for fastening scarfs and other articles of dress.

933. To Etienne Mathurin Léon Maxant, of the city of Paris, in the republic of France, for the invention of "Improvements in invisible clockwinding mechanism with permanently located keys."

425. To Arthur Charles Henderson, of 6, Southampton Buildings, Holborn, in the county of Middlesex, for the invention of "Improvements in chronometers, clocks, and watches, and other horological instruments."—A communication to him from abroad by Marie Edouard François, of the republic of France.

Patents Granted in Foreign States.

United States of America.

211,323. Darwin Ellis, of Waterbury, and Frederick L. Ellis, of Milldale, Conn., for "Manufacture of watch-keys."—Application filed 6th November, 1878.

211,558. Robert W. Enwards, of San Francisco, Cal., for "Finger-rings."—Application filed 19th August, 1878.

211,584. Samuel G. Parker, of Dyersburg, Tenn., for "Regulator attachments for watch dustcaps."—Application filed 28th June, 1878.

211,594. Alfred Schofield, of Wrentham, Mass., for "Scarf-rings."—Application filed 19th August 1878.

211,816. Theodor Weisser, of Furtwangen, assignor to Junghans Brothers, Schramberg, Würtemberg, Germany, for "Calendar-clocks."—Application filed 11th December, 1878.—Patented in England, 14th October, 1878.

211,918. Charles E. Lombard, of Cambridge, assignor of one-half of his right to Charles F. Brown, of Reading, Mass., for "Watch and clock keys."—Application filed 24th May, 1878.

211,936. Silvestro Seighelli, of San Francisco, Cal., for "Winding attachments for clocks."—Application filed 22nd November, 1878.

211,992. Max L. Gutmann, of Rochester, N.Y., for "Ajustable watch-keys."—Application filed 16th December, 1878.

212,220. George A. Harmount, of New Haven, Conn., assignor to the New Haven Clock Company, of the same place, for "Clock-dials."—Application filed 23rd September, 1876.

212,240. William Lindon, of Brooklyn, N.Y., for "Striking mechanisms for clocks."—Application filed 19th November, 1878.

France.

126,407. Japy Brothers and Co., for "Improvements in cabinet clocks."—Dated 5th September, 1878.

126,368. Motto-Muriaglio, for "Applying pictures and drawings on clock faces."—Dated 6th July, 1878.

INQUIRIES CONCERNING PATENTS.

Inquiries made relating to British and Foreign Patents. Specifications and Drawings of Inventions Supplied. Strictly Confidential. Fees moderate.

A. FISCHER,

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MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Bowen, John, 46, Glasshouse St., Regent St., watch and clockmaker. Feb. 24. W. J. Mitton's, sol., 2, Gray's Inn Square.

Faller, Benedict, Vicar Lane, Leeds, jeweller. Feb. 22. Simpson & Burrell, sols., Leeds.

Ward, Robt., Stonegate, York, jeweller & silversmith. Feb. 27. J. C. James, sol., York.

Wray, Wm., Gt. Horton, near Bradford, & Tyrrel St., Bradford, watchmaker. Feb. 25. Wood, Killick & Hutton, sols., Bradford.

Franks, Louis Aubrey, King St. and Deansgate, Manchester, optician. Mar. 3. J. Best., sol., Manchester.

Goodman, Julius, Deansgate, Manchester, jeweller. Mar. 6. J. Sampson's, sol., 40, South King St., Manchester.

Bernsztien, Napolian, Mount Pleasant, Upper Bangor, jeweller. Mar. 3. J. W. Hughes, sol., Bangor.

Johnston, Wm., Park Terr., Gateshead & Newcastle, jeweller. Mar. 3. D. E. Stanford, sol., Newcastle.

Jones, Evan, Pride Hill, Shrewsbury, watch and clockmaker and silversmith. Mar. 3. H. Morris, sol., Shrewsbury.

Minoggio, Louis Jules Antonie, 13, Charles St., Middlesex Hospital, jeweller. Mar. 5. M. H. Lewis, sol., 2 Weymouth St., Portland Pl.

Touzon, Joseph & Eugene Moise Silveyra, 13, Frith St., Soho Sq., jewellers and ring makers. Feb. 26. G. C. Winkworth, sol., 326, Oxford St.

Truscott, Thos., Market Sq., Narberth, Pembrokeshire, watchmaker. Mar. 3. W. M. Griffiths, sol., Carmarthen.

Bradshaw, Wm. Septimus, Friargate, Preston, watchmaker, Mar. 14. W. Cooper, sol., Preston.

Brenholz, Harris Davis, Vyse St., Birmingham, late jeweller, Mar. 8. C. B. Hodgson & Haigh, sols., Waterloo St., Birmingham.

Gregson, Thos., Collingwood St., & Cromwell St., both Newcastle, watchmaker. Mar. 11. T. J. Forster, sol.

Laval, Marc & Harry Millward Wright, 10, Thavies Inn, watch manufacturer. Mar. 11. J. Atterborough, sol., 63, St. Paul's Church Yard.

White, Joseph, Gt. Charles St., Birmingham, & Yardley, Worcestershire, electro-plate manuf. Mar. 12. M. A. Fitter, sol., Bennett's Hill, Birmingham.

Cook, Hannah, Chas. Frederick Cook & Thos. Cook, trdg. as T. Cook & Sons, York, opticians, engineers, clock makers, &c. Mar. 22. At North Eastern Hotel, York, Apr. 16, at 2. J. P., H. & J. R. Wood, sols., York.

Cook, Chas. Frdk., Gate Fulford, Yorks, & York, optician, engnr., clock maker &c. (sep. crdtrs.) March 22. At North Eastern Hotel, York, Apr. 16, at 3. J. P., H. & J. R. Wood, sols., York.

Cook, Thos., Gate Fulford, Yorks, & York, optician, engnr., clock maker, &c. (sep. crdtrs.) Mar. 22. At North Eastern Hotel, York, April 16, at 3½. J. P., H. & J. R. Wood, sols., York.

Pearson, Amos, Grosvenor Rd., Tunbridge Wells, & London Rd., Southborough, watchmaker & jeweller. Mar. 19. At J. Burton's, sol., 15, Serjeants' Inn, Fleet St., Apr. 8, at 11.

Robinson, Dalton, Millbank St., Middlesborough, jeweller. Mar. 17. Jackson & Jackson, sols., Middlesborough.

Campbell, Thos., trdg. as John Campbell, South Castle St., Liverpool and Higher Tranmere, Cheshire, jeweller. Mar. 28. At Gibson, Bolland & Jackson's, accts., South John St., Liverpool, Apr. 21, at 3. T. J. Smith & Son, sols., 6, Newington, Liverpool.

Collins, Charles, Gt. Portland St., optician. Mar. 25. At Messrs. Harrison's, sols., 3, Fowkes Buildings, Gt. Tower St., Apr. 15, at 12.

Fehrenbach, Pius, 25, Scotch St., Carlisle, jeweller. Mar. 24. At J. Errington's, sol., Carlisle, Apr. 10, at 3.

Levin, Alexander, Vyse St., Birmingham, jewellers' factor. Mar. 26. At C. B. Hodgson & Haigh's, sols., Waterloo St., Birmingham, Apr. 10, at 12.

Nickolds, Philip, Stafford St., Brewood, Staffs., watchmaker. Mar. 29. At W. J. Rutland's, sol., Wolverhampton, Apr. 12, at 11.

Spong, Ambrose Reilly, Ryland Rd., Birmingham, late Bournemouth, prev. New St., Birmingham, jeweller and dealer in fancy goods. Mar. 21. At Collins & Wilkinson's, sols.

Thornton, Wm., Regent St., Leamington, watchmaker. Mar. 25. At W. B. Sanderson's, sol., Warwick, Apr. 21, at 1.

Page, John G., 20, Shoreditch, jeweller. Mar. 24. At E. Attee's, 68, Lower Thames St., Apr. 12, at 4.

Trustees Appointed.

Fuld, Bernhard (Liq.), Leather Lane, Holborn, & Springdale Rd., Green Lanes, diamond worker. Tr., S. Seear, Holborn Viaduct, accountant.

Hart, Francis G., Highbridge, Somerset, watchmaker, Tr., J. S. Pitt, Bristol, accountant.

Baumann, Chas. H. (Liq.), Nottingham, watchmaker. Tr., T. Leman, Nottingham, accountant.

Dividends.

Rowson, Henry (Bkt.), Exchange St. East, Liverpool, jeweller. 1st & final div. 2/-; E. B. Roose, 26, North St., Liverpool.

Vuilleumier, Jean C. P. (Liq.), Welbeck St., watchmaker. Div. 8d.; F. B. Leeming, 10, Coleman St.

Liberman, Hyman & Jno. Buirski (Liq.), Burslem, jewellers. 1st & final div. 1/3; E. Sherratt, Waterloo Rd., Burslem.

Dissolutions of Partnerships.

Samuel, S. M. & Co., Church Row, Houndsditch, importers of Swiss watches. Feb. 11. Debts by Samuel Morris Samuel.

Stratford, W. & H., Sheffield, electro plate manufacturers. Feb. 28. Debts by Henry Stratford.

Woodroofe, R. & Sons, Duke St., Liverpool, & Liscard, Cheshire, jewellers. Nov. 20.

Adjudications of Bankruptcy.

Pairpoint, Edward Jas., 44, Greek St., Soho, & 1, Enfield Rd., Hornsey, silversmith. Mar. 20. At Bktcy. Ct., Lincoln's Inn Fields, Apr. 9, at 2. Hazlitt, Reg.

Bowen, Anne, Upper Brook St., Chorlton-upon-Medlock, and Oxford Rd., Manchester, jeweller and toy dealer. Mar. 24. At C.C., Manchester, Apr. 21, at 11. Lister, Reg.

Brenholz, Harris Davis, tdg as H. Suckerladen & Co., 86, Vyse St., Birmingham, jeweller. Mar. 27. At C.C., Birmingham, Apr. 17, at 2. Parry, Reg.

Wray, Wm., 31, Tyrrel St., Bradford, watchmaker. Mar. 28. At C.C., Bradford, Apr. 18, at 2. Robinson, Reg.

Scotch Sequestrations.

Desh, Leonard, Dundas St., Glasgow, jeweller, etc. Tr., R. B. McCaig, 179, West George St., Glasgow, Com. L. Rombach.

Trust Deeds Granted.

Calvert, Arthur, Wellgate, Dundee, watchmaker, etc. Claims with Miller and Ferguson, Queen St., Glasgow, by April 12.

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Allgemeines Journal der Uhrmacherkunst.

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BRONZES.

By C. D. E. Fortnum, F.S.A.

(Continued from page 121.)

It is difficult and almost impossible to imitate perfectly the natural patina of an antique bronze; and the eye of a practised connoisseur will not be satisfied with the presence or absence of patina alone, in his judgment of the authenticity of an object submitted to his scrutiny. There are characteristics which it would be hard to define, but which long experience will unveil to a man naturally gifted to appreciate the artistic spirit of works of various periods, and the nice distinctions which exist between the real object and an imitation. Occasionally an ancient work may be passed by, or even condemned as a reproduction, which has suffered from the over-nicety of a possessor or the excess of assiduity on the part of the cleaner and restorer, who sometimes have thought their own new colourings better than the old. The imitation of the antique patina has generally been kept secret by those who have practised it with the greatest success, for obvious reasons—the bronzes so coloured being for the most part forgeries of the antique.

One well-known method, the success of which greatly depends upon its skilful use, is to mix twelve parts of common salt with six of the bi-tartrate of potass and two of sal ammoniac, dissolving in twenty-four parts of boiling water, and adding thereto from eight to ten parts of the strong solution of nitrate of copper. This mixture is to be washed over the surface of the bronze, which must be kept in a damp place, frequently repeating the application as it slowly dries, and until a truly antique effect is produced, which is heightened by polishing. Another method is by covering the bronze with a mixture of sulphate of iron, vinegar, water, and sugar, in proportions varying with the judgment and experience of the operator. For giving an even tone, without doing more than softening the glitter of the new metallic surface, some bronzists have merely washed their work with a solution of the muriate of ammonia, leaving time to do the rest. A thin greenish varnish was used by others —an objectionable method; as was also that so frequently applied to bronzes of the sixteenth century, namely, an artificial glazing of dark brown, which, like the last, frequently scales off, leaving uncovered patches of the metal.

There are other methods also of imitation and of heightening the effect of a surface which had been rendered dull by damp or ill-treatment. Thus the application of almond oil, in which flower of sulphur has been long macerated and exposed to the action of the sun, is useful in some cases; mercurial ointment in others; while the smoke of slowly-burning green willow twigs or laurel leaves, and that arising from old shoes, are valuable agents in experienced hands, and, to name no more, sal ammoniac for the antique patina.

The use of the alloys of copper in the multifarious production of weapons, tools, domestic and culinary utensils, sacrificial and sepulchral vessels, armour, hinges, and locks, even roofing-tiles and wall-linings, personal ornaments, etc., etc., has been so extensive and continuous thoughout the world's history, that we can only offer a few and cursory remarks upon the development of its many appliances. Carefully to trace the use of bronze in its application to the various branches of the plastic art would be little less than a history of the progress of sculpture, a subject far too vast and too important to be here attempted. We must content ourselves, therefore, with a hasty glance at the employment of bronze by various races of mankind, from that remote period when the bronze age in different countries was overlapping on the one side the newer age of stone, and on the other the gradual extension of the use of iron.

(To be continued.)

NEW PATENT BILL.

The new Patent Bill introduced into Parliament has just been published, and the following are its principal provisions:—

1. The duration of provisional protection is to be extended from six months to one year, and the stamp duties thereon lowered to half their present amount.

2. A complete specification must, however, be filed before the expiration of nine months from date of original application, or the protection will terminate at the end of twelve months and cannot afterwards be renewed.

3. The complete specification shall be immediately published with all other documents relating to the case, and for a prescribed period anyone shall be at liberty to oppose the grant of a patent.

4. If there be no opposition the applicant may give notice to proceed, and secure his patent for half the stamp duties now levied.

5. A patent shall last for twenty-one years instead of fourteen, but shall become void if the £50 and £100 stamps be not duly paid at the end of the third and seventh years respectively, and an additional stamp of £100 before the end of the twelfth year.

6. Patents can be amended or added to hereafter, but with such fees and limitations as to make an amendment—especially if an addition—almost as costly as an original patent. The amendment, however, then becoming part of the original patent, is not subject to additional stamp duties. (This, however, is still a great improvement over existing practice, and all alterations mentioned so far are in favour of the patentee.)

7. The Crown shall have power to use any patented invention, paying the inventor such royalty as the Treasury shall consider fair.

8. If an inventor do not work his invention in the country within three years of grant, and if he refuses to grant licenses in such terms as the Lord Chancellor shall consider reasonable, the patent will be annulled.

9. Inventions first patented (or imported from) abroad can, in future, be patented in England by the foreign patentee (he being the true and first inventor) within six months of the date of the foreign patent, or of the date of this Act. But such patents will fall with the expiration of any foreign patent for the same invention, whether granted before or after date of such patent.

10. The Lord Chancellor shall have power, in certain cases, to allow a patentee, who has accidentally omitted to pay his tax in time, to pay it within three months after it became due, and thereby save his patent.

11. All patents applied for before the passing of the Act to be independent of all its provisions, except Article 10.

12. The modes of procedure are altered in many respects interesting only to patent agents and lawyers.

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THE
WATCHMAKER
JEWELLER.
AND
TRADE
SILVERSMITH'S
JOURNAL.
W H TILBY

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall.—Registered for Transmission Abroad.

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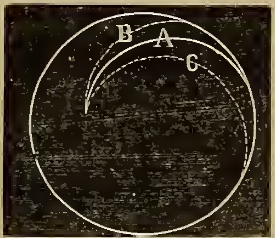
No. 48.—Vol. IV.] MAY 5, 1879. [Subscription, 5s. per Annum. } Post Free.

HOROLOGY.

(*Continued from page* 128.)

XLI.—Adjustments to Positions, Isochronism, and Compensation.

"If we compare the inner coils of a flat spring with the outer," says Immisch, "and try to bend them by opposite central forces, with a pair of tweezers, for instance, we find that the outer coils give way much easier, which proves that the smaller have a greater degree of rigidity; by bending the outer turns towards the centre, therefore, we impart more rigidity to the end, causing it to oppose a greater resistance to a bending force, so that when the vibrations are small the greatest strain is farther from the centre. It stands to reason that if the curve is too abrupt the length to which this greater rigidity is imparted is shorter; if the curve is more gentle, beginning farther from the end, the greatest strain will be farther from, and will be enabled more gradually to advance towards, the fixing point. If, therefore, the watch loses in long vibrations, and the curve of the spring should have the form A, it will have to be changed to a form approaching B; and if it gains in long vibrations the curve must be begun farther from the end, approaching the form C.



"It is evident that a helical spring having both ends turned in, offers a larger scope for operation than the Breguet spring. Both, however, have the important advantage in common that they emancipate the balance from the side pressure of the pivots in their holes. The outer end being fixed within the circle of the spring, and the curve itself expanding, the free end of the curve, which is also the commencement of the circular coil, is enabled to recede from, and to advance towards, the centre, according to the direction in which the balance is moved, while when the extreme end of the last circular coil is fixed the expansion and contraction is one-sided, causing a side pressure in their holes; we can, therefore, with a Breguet or cylindrical spring, obtain a greater arc of vibration with a smaller amount of motive force.

"In the case of spherical springs, a greater rigidity is given to the ends, not only by the smaller diameter of the outer coils, but also by the different inclinations which the flat sides of the spring have to the plane of the motion. The centre coil, the sides of which are exactly rectangular to the plane of motion, will, therefore, be affected most. The isochronal adjustment of this spring consists in lengthening and shortening it, and bringing the watch to time by altering the balance. The spring stands in the same predicament as the tapering flat one, and as no particular advantage attaches to this form which would compensate for the greater difficulty in making it, it is very seldom resorted to, and belongs to the class of fancy forms, if I may use this expression.

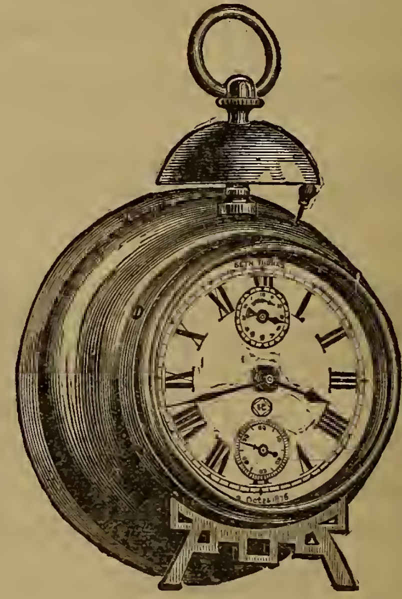
"We see that in all these different forms the principle of adjustment of isochronism is the same, although the manipulations differ. The motion of a spring may be imagined as a struggle between the body of a spring and the extremities. Although when the spring is inflected *all* the coils bend, it is in point of fact the resistance of the extremities which checks the force of the momentum of the balance. It stands to reason that in order to have the greatest strain at the proper distance from the centre, the absolute elastic force of the body of the spring must be exactly even throughout its whole length, or (in the case of flat springs) exactly proportionate to the length, because if this proportion is not even, and there should be a weak place in any part of it, the greatest strain would be *there*, and not where it ought to be, and any change effected in the extremities will be more or less ineffective. It is, therefore, of the utmost importance that the degree of hardness should be absolutely uniform throughout the spring. Care should also be taken that the body of the spring should not get bent, as the rebending it to its former position causes an unevenness of the texture of the metal. The unevenness caused by such a proceeding will be greater when the material is soft.

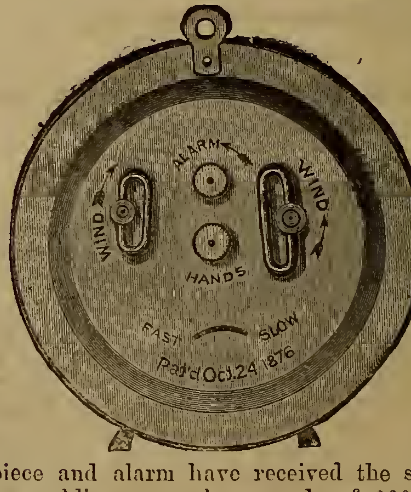
"If we bend a piece of metal and try to bring it back to its former shape, it will bend in a different place; everybody knows how difficult it is to straighten a pin when it has been bent. If a spring has been bent and it is *forced* back into its original position, the elastic force will be diminished at the point so forced. The mere fact of bending it in the first instance has an effect detrimental to its elastic quality. It is, for instance, well known to watchmakers, and many have found it out to their trouble, that the bending of a gong wire in a repeating watch, in order to free it from any point it touched, diminished the sound considerably, and heating the spring would only partially restore the tone. The best way to proceed in such a case is this: if the spring touches on the outside and must consequently be bent inwards, it should be, at the place where it is to be bent, laid upon a convex piece of brass corresponding in shape with the inner side of the spring; then if the outside be slightly hammered with the sharp edge of a hammer the small indentations produced will cause the outside to be lengthened a little, and the inside to contract in proportion. The change of form will be very gradual, and the granular disturbance, being spread over a larger area, will not be great enough to affect the tone in the least. The more a spring is bent to and fro in any direction the more it will lose its elastic force. It is for this reason that a beginner will often spoil a spring by over-manipulation, making it ultimately unfit for isochronal purposes. Especially in soft springs care should be taken to make any change very gradually, and rather oftener than too much at once, and thereby necessitating the bending back of the spring. If quite a soft spring, perfectly adjusted, should be bent and brought back again to exactly its former position, the vibrations would be isochronous no more, and by repeating the experiment the elastic force of the curve will become so small compared with that possessed by the body of the spring, that instead of exercising a control over the latter its motion becomes subservient to it. A harder spring will bear a much greater amount of over-manipulation, and a Breguet spring, the form of which in itself necessitates a certain amount of bending, must always have a greater degree of hardness than that necessary for helical springs, in order that the advantage possessed by this form should be of the greatest possible use. It is also necessary that a certain time should elapse before ascertaining the result of the change effected."

(*To be continued.*)

IMPROVEMENTS IN ALARMS.

We have pleasure in drawing attention to the new Nutmeg Lever Timepiece Alarm manufactured by the Seth Thomas Clock Company, New York, who are represented by Mr. Marples, of 16, Worship-street, E.C. This is a great improvement upon the old alarm, the hammer of which struck against the side of the case like most of the French alarms. In the new model there is a finely plated bell over the top of the clock, the tone of which is musical and pleasant, while it is loud enough to wake any but the "seven sleepers."





Both timepiece and alarm have received the strongest evidence of the public approval, upwards of 300,000 having been sold in little over two years. The company are now introducing their "Joker" Timepiece Carriage Clock, to which we shall refer more at length next month, and which bids fair to rival the Nutmeg in popularity.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. II.

(Continued from page 131.)

THE object in adding the soot to the aquafortis is to deoxidize, by its carbon and hydrogen, a small proportion of nitric acid, so as to convert it into nitrous acid, which, combining with the chlorine of the common salt (chloride of sodium), forms a slight proportion of aqua regia required in the process.

Great care should be bestowed in the selection of aquafortis. There are three varieties of nitric acid at 36° in commerce: the first is colourless, the second of a straw-colour and the last of a more or less deep red. The white or colourless acids contain no nitrous gas and cleanse badly, especially at the beginning. The red acids combine considerable proportions of chlorine, bromine and iodine and act too powerfully and pit the copper. The straw-coloured acids, on the contrary, possess a proper degree of nitric and nitrous acid, and should be used in preference to all others. Nitric acid of 40° should be rejected in practice as too active and too expensive, although it is sometimes used by operators having large quantities of copper to cleanse, because it accelerates the process. Spent aquafortis may easily be recognised by its very slow action on copper, and by a bluish white film which covers it on withdrawal from the liquid. The acid must then be reserved for the previous operation, *i.e.*, the dipping in old aquafortis, or for the preparation of the whitening bath of which we shall speak further on. Acids, even of excellent quality, may sometimes perform a very imperfect cleansing only, in consequence of a too great a rise or fall in temperature; this fact accounts for the difficulty experienced in performing these operations during frosty and very hot weather.

Aquafortis for Bright Lustre.—There is an excellent way of obtaining a bright lustre for any pieces, the surfaces of which have been dulled or slightly pitted by a defective cleaning, or by their passage through the acids for removing gold or silver. Place them for a few minutes in a bath composed of:

Old aquafortis, nearly spent,	1 part.
Hydrochloric acid	6 ,,
Water	2 ,,

The pieces, when removed from the bath, are entirely black, and must be thoroughly rinsed in water to remove the kind of black mud which covers them. They are then cleansed and dipped again. This bath will be found useful by electro-gilders. It is also convenient for removing the sand adhering to the castings of copper alloys. Large pieces may remain in the bath for 20 or 30 minutes, as this mixture acts very slowly on copper and its alloys.

Dipping in Compound Acids for a Bright Lustre.—These acids are of two kinds, according to the object in view. If the objects are to have a bright lustre, they are immersed and stirred for a second or two in a liquid prepared the day before, so as to have it perfectly cold and composed of:

Nitric acid at 36°, 100 parts in volume and not in weight.
Sulphuric acid at 66°, 100 parts ,,
Common salt, about 1 part ,,

It is absolutely necessary to rinse the articles rapidly and in plenty of water after withdrawal from this bath.

In preparing this bath it is also necessary to put the nitric acid into the vessel first, and then the sulphuric acid, which is much denser, and would not mix readily if it were put in first. At the time of mixing, especially when the salt is added, considerable heat and a quantity of acid and injurious fumes are produced, so that it is advisable to operate in the open air or under a good chimney-hood with a movable glass sash. For this reason it is essential that these acids should be employed cold; it is, therefore, necessary to prepare them in advance; should the acids, however, be required for immediate use, they can be rapidly cooled by surrounding the vessel containing them with ice or cold water.

Copper articles, after this dipping, are lighter coloured and much brighter than after the passage through aquafortis. They may then be considered as completely cleansed, and must be immediately rinsed in plenty of clean water. The above acids are too active for small articles, such as pins or hooks, which are generally cleansed in stoneware colanders. As the number of small articles stops up the perforations, the acid cannot run out so quickly as desired, and begins to heat and give off fumes, and the pieces blacken before they can be rinsed. Therefore, for such small pieces, add to the above mixture one eighth of its volume of water. This mixture is termed "bitters." A method often employed is to place the articles in a stoneware pot, they are then rapidly stirred with a small quantity of bitters and the whole is plunged into a quantity of fresh water as soon as the acid has sufficiently acted. This method is not economical, the acid being lost, but on the other hand has the advantage that the liquids do not become heated.

Whitening Bath consists of old aquafortis, sulphuric acid, sea salt, uncalcined soot. Pour into a large stoneware vessel a certain quantity of old aquafortis from previous dippings, and then add twice the volume of sulphuric acid at 66°. The mixture is allowed to cool off until the next day. The nitrate of copper of the old aquafortis becomes converted into the much less soluble sulphate of copper, which, by cooling, crystallizes against the sides of the vessel. Decant the liquid portion into another vessel, and then add 2 or 3 per cent. of sea salt, and as much of calcined soot. This mixture is much less active than the compound acids for a bright lustre, and often replaces them advantageously. The crystallized sulphate of copper is collected and sold. This bath is revived when necessary, by the addition of stronger aquafortis and oil of vitriol. To replace the portion used up during the day, equal quantities of old aquafortis and oil of vitriol are added at the end of the day.

The next morning the liquors are decanted, to separate the fresh crystals of sulphate of copper which have formed. Soot and sea salt in sufficient proportions are then added. In this manner a perpetual and cheap whitening bath is prepared.

(To be continued.)

Royal Plate.—The Royal plate at Windsor, of which an inventory had been taken, previous to the departure of her Majesty the Queen for Italy, is stated to be of the value of £1,800,000. It includes a gold service ordered by George IV., which will dine 140 persons, and one of the finest wine coolers in the world, added to the collection by the same monarch; a shield formed of snuff boxes worth £9,000, and thirty dozen plates worth £10,000. There are also a variety of pieces brought from abroad and India. The latter include a peacock of precious stones of every description worth £30,000, and Tippoo's footstool, a tiger's head with crystal teeth, and a solid ingot of gold for his tongue.—*Echo.*

Little pigs in gold and silver are now worn by everybody in Vienna as jewellery. Pins, charms, bracelets, stick-handles—everything is for the moment porcine. The Court began, and the rest of the world naturally followed the lead. The fashion has come from Germany, and was introduced to commemorate the happy escape of the Emperor William from all the risks and dangers he has lately run, and his "Schweins' glück," or pigs' luck—meaning splendid luck—as the German phrase goes, in coming out of it all so well.

JEWELLERY.

By George Wallis.

(*Continued from page* 116.)

WHEN stones are to be set as details, or when they constitute the real basis of the design, the gold is gradually wrought to receive the stones in their proper position. The setting is never effected, as may be supposed, by being cemented into position, for the metal itself is so wrought that, after the stone is placed in its proper receptacle, the gold is closed firmly over the edges of the cut gem, holding it securely in its place. At a comparatively recent date ready-made mountings for stones, produced by machinery, have been in use, not only in imitation but in real work. These are so contrived that the various portions of an article are cut separately and afterwards soldered together in such a manner as to receive the stones for fixing in the usual way. A still cheaper process is also in use, consisting of a strip of metal having a serrated edge. The proper portions of the strips of metal being fixed to receive the stones, the serrations are bent over to retain them.

To set gems properly, so as to bring out all the beauty and special features of a stone according to the cutting, requires great experience and sound judgment. The angle at which one stone is fixed in relation to another, the importance of the light being not simply refracted, but seen in transition so as to bring out the beauty of the colour, are points which require no ordinary consideration; for stones, which by one mode of setting would look very brilliant, may be made to look very commonplace by another mode.

Enamelling is largely employed in the embellishment of jewellery, to give variety of colour and contrast to surfaces. This may be described as essentially of two kinds, *champlevé* and *cloisonné*. The former is a method or system by which the enamel is applied to the surface of the metal, thus giving the details by means of a vitreous paste, which when fixed by heat becomes attached to the metal, either as an opaque or transparent body. Here again, as in the case of the manufacture of paste or artificial stones, the metallic oxides come in as colouring substances. One species of *champlevé* enamel approaches the *cloisonné* in character, from the fact, that the enamel is fired into channels cut in the surface of the metal by the graver, these channels form a bed in which the vitreous paste is secured by the side walls of the fissures incised for the purpose, and so far serve the same purpose as the metal partitions used in the *cloisonné* method. This latter is of Oriental origin, and is similar to that employed with such remarkable success in the elaborate enamelled decorations of the Japanese and Chinese.

The surface to be decorated *à la cloisonné* (from *cloison*, a partition wall), is divided into sections according to the nature of the designs to be produced by the raised tints of enamel to be employed. The outline of each section is given by a wall composed of a thin piece of metal cut and bent to the proper shape, and soldered at right angles to the surface. Thus, prior to the insertion of the vitreous substance which, when fused, becomes the coloured enamel, filling up each division with its proper tint, the design is represented in outline by the thin walls of metal soldered upon the surface. After the fusion is completed, the whole is ground down to a uniform surface of metal and enamel, the metal giving a bright outline running between the various tints of colour employed. The fusion is produced by submitting the object to be enamelled, or such portion of it as may be easily handled, to the action of a charcoal or coke fire, raised to a sufficiently intense heat inside a muffle or furnace, practically under the eye of the enameller, who watches the progress of the fusion, and regulates the application of the fire accordingly. It is needless to say that the vitreous paste which constitutes the enamel, is fusible at a much lower temperature than the metal which forms the structure of the object. Some vitreous pastes for enamelling purposes are so easily fusible, or technically so *soft* that they can be fused by a blowpipe in an ordinary candle; but these are essentially for surface decorations in colour, mostly on surfaces already covered with a coating of white enamel paste.

Enamelled details of this class are extensively used by some jewellers as a speciality; able painters in enamel, such as Essex, Bell, and others, being employed to paint the subjects, which, however, have been principally heads of animals, the favourite subjects being after Landseer. The enamelling is done in gold, the name of the artist and date of the year being painted on the back of each subject. These are principally used for gentlemen's scarf pins or scarf rings. Other subjects, such as classical heads painted in cameo effects, are also used.

Another method of decorating the surface of jewellery is by engraving. This is largely and almost universally employed for the delicate details of modern jewellery, and is, for the most part, the result of the dexterous use of the graver. These details are the subject of careful consideration on the part of the designer and manufacturer, especially in the best class of work. The skill and dexterity with which some objects are embellished by rich diaper work and scrolls, sometimes intermingled or varied with engine turnings, carried over surfaces which would otherwise present a monotonous and unsatisfactory appearance, is very remarkable. The brilliant variation of the metal, and the play of light and shadow thus introduced, without interfering with the generic form, give great art value to what might otherwise look heavy and uninteresting.

As a matter of course, machinery and mechanical contrivances of an elaborate or permanent character can only be economically employed where a number of articles of the same design are required to be produced, or where the details of the article admit of repetition to a very large extent. A chain is an extreme example of the economic value of machinery when employed in its production. A brooch or bracelet is the very reverse, except where a very large number are required to be manufactured, as in the instance of imitation jewellery of a cheap class.

The first step towards a mechanical means of repetition is made, when a number of articles of the same size and design are required for the market. In that case, a die or dies are cut in steel for the exact and ready repetition of the various details which go to the making up of the design as a whole. Say, for example, the decorative gold drops to a pair of earrings. In this case the two sides of each drop will be produced from the same die, making four repetitions in a single pair. The die being cut to the design, the workman takes a thin plate of gold of the proper size, and proceeds gradually by the use of hammer and punch to drive the metal into the hollow of the die; as he does this, he has from time to time to anneal the metal, as already mentioned in the illustration of the *repoussé* process used in high-class hand work. Of necessity he gets a number of these plates into the same condition, anneals them, and then goes on again. Ultimately each piece of gold takes the shape of all the details, and also the surface of the *intaglio* of the die; being, in fact, a *relievo* representation of it. When completed, the two sides of the ear drop are soldered together by the use of the blowpipe, gold solder of a suitable alloy to be readily fused, and a little borax, as a flux, being employed in uniting the edges. Filed and smoothed, the proper fitting to the hooks which suspend the earring and drop to the ears has also to be accomplished by hand, the hook itself and the rosette, or other decorative detail, from which the drop is suspended, being also produced either from another die, or by some other mechanical contrivance.

(*To be continued.*)

TRADE RECIPES, &c.

(*Continued from page* 131.)

Zinc is made easier soluble by the addition of 10 per cent. of bismuth or cadmium, or 5 per cent. of each. With this addition, zinc melts twice as easily as otherwise.—*Inventors' Record.*

Alloy for Soldering Tin or Zinc Plates.—An excellent alloy for soldering tin or zinc plates is obtained by mixing two parts of lead with one part of English bar tin. The lead is melted first, and after removing the lead dross formed by melting, the tin is added.

A Capital Bronze.—It consists of 89·5 parts of copper, 7·5 of zinc, and three parts of tin. Specially suitable for monuments, statues, etc. If the metal, however, is required to be malleable for different kind of works, then the composition should consist of 65¼ parts of copper and 34¾ parts of zinc, when a metal will be obtained which is durable and easily worked.

Beautiful Black Colour for Bronze.—A strong concentrated thin solution of nitrate of silver is required for this purpose. It should be mixed with an equal solution of nitrate of copper, and well shaken together. The pieces which require colouring are dipped into this solution and left for a short time. When taken out, they should be equally heated till the required pale black colour makes its appearance.

Black Polish on Iron and Steel.—To obtain that beautiful deep black polish on iron or steel which is so much sought after, it is required to boil one part of sulphur in ten parts of oil of turpentine, the product of which is a brown sulphuric oil of disagreeable smell. This should be put on the outside as slightly as possible, and heated over a spirit lamp till the required black polish is obtained.

Fusible Bronze.—A very fusible bronze is obtained by the addition of tin; but by adding too much tin the bronze becomes dry, and especially in using it with large articles, where an unfavourable straining or tension takes place, it cracks quickly. To avoid this, the bronze should be composed of 82·45 parts of copper, 10·30 parts of zinc, 4·10 parts of tin, and 3·15 parts of lead.

Brass and Bronze Trimmings and Ornaments.—The use of nickel trimmings is objectionable. The cold blue-white colour of nickel neither harmonises nor pleasantly contrasts with the black it is intended to relieve. It is discoloured by heat and sulphurous gases. We have two substances for nickel as a coating for plates and trimmings—copper and brass. Copper is one of the easiest and cheapest of the metals to electro-deposit. Treated with proper acid and alkaline solutions, it can be made to resemble any shade of bronze, and bronze panels and trimmings would be exceedingly beautiful, as well as novel. It is strange that copper was not so used, especially as its employment entails no practical difficulties, and the conversion of a nickel into a copper-plating plant demands only a tank to hold the copper solutions and copper anodes. Brass-plating is a comparative novelty. It is only lately that entirely satisfactory results have been obtained in the electro-deposition of this alloy, which, next to gold, is the most beautiful of the metals.

How to Colour and Finish Brass.—In technical language, bronzing is taken to include all colours, and not brown alone, as in its original sense. To obtain the various tints embraced in the term bronzing, the brass is, for browns of all shades, immersed in solutions of nitrate, or the perchloride of iron, the strength of the solution determining the depth of colour. Moist, red oxide of iron burnt on the surface of the brass, and polished with a very small quantity of black-lead, gives a chocolate finish. A steel grey colour is deposited on the metal by a dilute boiling solution of chloride of arsenic, and blue by careful treatment with strong hydrosulphite of soda. Violet is produced by dipping in a solution of chloride of antimony, or of perchloride of iron. The black so much used for optical brass work is produced by coating the surface with chloride of gold mixed with nitrate of tin or with a solution of platinum. To obtain olive green, the process is more varied, as the surface has first to be made black with a solution of iron and arsenic in muriatic acid, after which it requires brushing with a black-lead brush, and then coating, when warm, with a lacquer composed of one part each of gamboge and lac varnish, and four of turmeric. It is highly important that before bronzing the brass work be annealed, pickled in dilute nitric acid, until the scales can be removed from the surface, and afterwards scoured with sand and water, and dried. There are some less elaborate, yet useful processes, such as the immersion of the brass in dilute acids, which, left to dry, produces a green coating of verdigris, which has a pleasing, antique appearance. A beautiful brown tint may also be given to brass, by leaving it for a time in damp sand, and afterwards polishing it with a dry brush, one of the merits of which finish is, that it will remain permanent. The successful practice of the art of bronzing will not, however, be attained without some experience, as only that can impart full knowledge of the effects of the temperature of the alloys and the solutions, what must be allowed for a difference in the quality of the materials, and the exact moment to unbath the metal. In a word, there are difficulties to be overcome of much the same character as those attending upon the tempering of tools.

New and Constant Bichromate Battery.—Dr. Erck exhibited lately before the London Physical Society a constant bichromate of potash battery. The ordinary bichromate battery soon loses power when in use, and in order to secure a powerful constant battery to drive a small astronomical clock, Dr. Erck devised the modified form shown. It consists of a narrow lead trough, 12 inches long by 3 inches wide and 1 inch deep, lined along both sides with the carbon plates. The zinc plate, 10 inches long, is immersed in the solution to the depth of an inch midway between the two carbons. A continual circulation of the bichromate solution is kept up by allowing fresh solution to drop into the cell at one end, and the exhausted solution to drop away by a tap at the other end. As the space between the two carbons is only about half an inch wide, there is merely a thin layer of solution between the positive and negative poles. The internal resistance of the cell is therefore very low when short circuited, only about ¼ ohm. To obtain the maximum current, about 8 ozs. of solution per hour should be supplied. Dr. Erck also showed a battery formed of zinc and carbon circular plates mounted on an axle, which is rotated by wheel work, thus mechanically stirring the bichromate solution.

Black Lacquer for Metal and Wood.—Nine parts of shellac are dissolved in fifty parts of methylic alcohol and set aside for a few days. Then ten parts of pulverised asphaltum are dissolved in fifty parts of coal tar benzine. Both liquids being mixed, a sufficient quantity of lamp-black is added to give it the required density. When necessary, it may be diluted with a mixture of alcohol and benzine.—*Chemiker Zeitung.*

Cement for Cast Iron.—Five parts of sulphur, two parts of graphite, and two parts of fine iron filings are melted together, taking care that the sulphur does not catch fire. The parts previously warmed are covered with the cement reduced to a pasty consistence on a fire, and firmly pressed together. This cement, it is said, is very well adapted to fill out leaks in cast iron vessels.

(*To be continued.*)

HINTS TO REPAIRERS.

(*Continued from page* 133.)

As we had the barrel and mainspring under consideration in our last article, it naturally follows that we take up the chain and fuzee in this. Before doing so, however, we will drill the hole in the barrel, if a new one, for the chain hook, which we omitted to do in our last. Of course this is done before the mainspring is put in. The barrel must be first put together with its arbor in; place it in position with the plates screwed in, then with the point of a knife or other convenient instrument, make a small mark on the barrel, about half the thickness of the chain, below the upper plate. Take out the barrel and drill a very small hole at about an angle of 45° to the radius, and in the direction to retain the hook of the chain when the watch is wound. Then with a small pivot broach (that will enter the hole) held between the thumb and finger of the right hand, and the barrel in the left, with the hole just drilled on its upper side, insert the broach and depress it as you revolve it, so as to make an oval hole instead of a round one; try the hook of the chain frequently, so as not to get the hole too large.

If the old chain is worthless, and a new one is needed, select one that you think to be about the right thickness, then with the fuzee in your left hand and chain in your right, fasten the *round* hook to the pin in the fuzee, and carefully wind the chain around it. If the chain goes down to the *bottom* of the groove easily, and yet *fills* it, it is of the proper thickness; if it does not fill these conditions select another one, and try again. Another important requisite is to have it of the proper length, to determine which you will put the fuzee, with the chain wound on it, in its place in the lower plate with the snail in the position it occupies when resting against the stop. Also put the barrel in the lower plate, extend the loose end of the chain on the barrel, and when hooked, from half to three-fourths of an inch should rest on the barrel. If much shorter than this there is danger of breaking the hook in winding; if much longer, the chain will be liable to run over the *upper* side instead of the lower, when the watch is running down. If, instead of putting in a new chain, it is desirable to mend the old one, or attach a new piece, observe the same conditions as for a new one. With a knife carefully open one end of the broken chain and remove the rivet, which is best done by laying the chain on a riveting stake, or other convenient metallic substance, and holding it down with the forefinger of the left hand, the nail of the same on the extreme end link, and if the knife is sharp you can insert the edge of it between the upper and centre plates forming the link; as soon as you have loosened the outer plate, turn the chain over, and loosen the opposite plate, then remove the centre one; if the old rivet does not come away with the centre plate, you can easily get it out with the knife. Now take the other piece of the chain and lay it down the same as you did the first one, only with the finger nail on the *second* link, and remove the two extreme outer plates by inserting the edge of the knife between them and the centre plate of the *second* link; remove the old rivet, and put the two pieces of chain together, being careful to have the convex face of both pieces on the same side; make a rivet out of steel wire that will fit the holes in the links; make the rivet nearly straight, and file it up with a *fine* file; have the chain lying flat on the bench; insert the end of the wire in the hole, and give the end of the pin vice one or two slight taps with a hammer, which will force the rivet in sufficiently tight. You can lift the chain up by the rivet if it is in tight enough. Cut off the end, and file it square with a fine file and nearly down to the chain, leaving just enough projecting so that you can perceive it with an eye-glass; cut off the other end and serve it in the same way, then lay the chain on the anvil of your vice and carefully rivet it together with a few light blows of the hammer.

Sometimes a chain will "turn" in the barrel, and persist in lying flat; some recommend reversing the chain, i.e., changing ends. This method is a mere make-shift for the time being. We should try and discover the cause of this trouble, and then apply the proper remedy. See if the barrel is upright and true, and if the arbor fits it well, and if the fuzee is also upright and its arbor fits well in the holes in the plate. If these conditions are not fulfilled, some one or more of them may be the cause of the difficulty. Again, a very frequent cause will be found in the mainspring, it being entirely too strong, or the chain may be a very inferior one. If so, it will be very apt to act in this manner. Sometimes the chain is not thick or strong enough, or it may be too long, which will sometimes cause it to turn. A watch will stop occasionally, and upon examination we find the barrel spread to such an extent that the chain rubs against the pottance, or it may turn down on its flat side on this account. As the barrel in this condition becomes a truncated cone, consequently the strain on the two sides of the chain is very unequal. Now it is not an uncommon thing, by any means, to find where someone has tried to remedy the spread of a barrel by hammering out the lid until it fits the barrel, then bringing the universal lathe (or still worse—the file) into requisition to turn out the pottance.

The universal lathe is an invaluable tool, but it is made the means of covering the gross ignorance of some so-called watchmakers, who never seem to be at ease when repairing a watch until they can get it up in the lathe, and turn out the pottance, barrel bridge, lower plate for central wheel, and *both upper and lower* plates for fuzee, and then, in case the watch fails to go, attribute the cause to the man who made it, feeling, no doubt, that he had done all that any one could do for such a watch. If these tinkers would confine their art of disfiguration to common watches no one would care much; but, no, even the finest watch is put through the same regular course.

The fuzee receives too little attention at the hands of the majority of workmen. We have known workmen who would polish the balance pivots, bush the small holes, etc., who would never seem to give the fuzee a thought. It is not our intention to enumerate the many make-shifts adopted by some to make the fuzee answer for the time being, but to give such practical directions for putting in a new one when needed, or of repairing the old one, when it will answer the purpose of a new one.

Let us suppose that the pivots are worn so that they have too much side-shake, the corners of the square are rounded, and the fuzee ratchet is worn out. These three repairs are frequently to be made in one and the same fuzee, so we will put them together and deal separately with the other difficulties; such as putting in a new click, new maintaining power spring, new fuzee, a great wheel, new fuzee arbor, etc.

Having satisfied ourselves with the repairs that we intend to make, first see if the depthing of the great wheel and centre pinion is correct before taking the fuzee apart, by putting the centre wheel and fuzee in the lower plate and trying them. This is necessary from the fact that the depth may have been changed by someone, or a new main wheel or centre pinion may have been put in that were not of the proper size.

(*To be continued.*)

Prices Current for Gold and Silver.—Value given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver 4s. 6½d. to 4s. 9d. (variable according to quantity).

HALL-MARKING.

THE following letter appeared in the *Times* of the 10th ultimo:

"SIR,—In a paragraph of the *Times* of to-day, Mr. George Attenborough, of Fleet-street, E.C., is reported to have stated, before the Select Committee of the House of Commons on hall-marking, that 'a new kind of fraud had recently been discovered in connection with gold watches,' and that he 'pointed out the ease with which the hall-mark on a silver watch could be altered to represent the hall-mark on gold, and produced a watch which had been so altered, and which purported to be of 18-carat gold, but which was in reality nothing but a silver one, skilfully gilded, etc.' Now, as the marking on silver is entirely different from that on gold—the hall-mark of the Goldsmiths' Company of London on a silver watch-case being a leopard's head and a lion passant, while on a gold case the hall-mark is a leopard's head and a crown and the figure 18 not half the size of the marks in the silver case (both cases containing the initials of the maker for identification, and a letter denoting the year in which it was marked)—it is not easy to see how this new fraud could be committed on any one who would be likely to use his own judgment in the matter; and as for passing off a silver gilt watch-case for a gold one, the dealer or pawnbroker who could be so deceived ought to learn his business over again. The truth of the matter is, there are certain members of the watch trade who dislike the competition of foreigners (greatly augmented by the recent depression of trade), and who are anxious to get some sort of protection from Parliament; but, knowing that under the name of protection the public might become alarmed and prevent the realisation of their wishes, they have been agitating in favour of more stringent regulations and larger powers being conferred on the Goldsmiths' Company and other corporations throughout the kingdom empowered to mark gold and silver wares, under the pretence of protecting the public from fraud, while their real object is to shut out foreign competition.

"The result of this movement may be found in a Bill introduced into Parliament by the member for Coventry, Sir Henry Jackson, the provisions of which you published some time ago, and which are so startling that one acquainted with the trade can scarcely believe it possible it will pass the House of Commons; but should it become law, three-fourths of the watches in London could not be legally sold—*i.e.*, the English-made watches; it would hand over a large portion of the trade to France and Switzerland, and would be most unjust and injurious to those who are endeavouring to conduct this manufacture on principles of freedom of trade, and exerting themselves to raise the standard of English-made watches by the development of technical skill and knowledge in the workmen, and who are not desirous of protection nor afraid of foreign competition.

"Yours, etc.,

"D. GLASGOW, Vice-President of the
British Horological Institute.

"20, Myddelton-square, E.C., April 8."

CAPE DIAMONDS.

CAPE DIAMONDS will have to fight for their rank among precious stones. There are some good stones among them, but there are some bad and many indifferent, so that the class, like all other classes, finds itself in danger of losing the name of diamond altogether through the inferiority of some of its individuals. A County Court Judge at Croydon had the other day to decide whether a certain Cape diamond came within the description of diamond under which it was sold. The purchaser, a lady of Croydon, gave £36 15s. for it set in a ring, and obtained a receipt as for a diamond ring. The lady afterwards found reason to suspect the genuineness of her purchase, and she sent the ring to London to be valued. The London jeweller set it down as worth 34s., being less shillings than the Croydon tradesman had obtained pounds for it. Accordingly the disappointed buyer brought an action against the tradesman to recover her money. The Judge decided in favour of the lady, pronouncing Cape diamonds as not to be regarded as diamonds. Notice of appeal was given, so that the stone in question will have a further opportunity of disputing its position in the world. It is a general maxim that a purchaser must look after himself, and cannot afterwards say that the purchase did not come up to his expectations. But this maxim does not apply when the purchaser asks for one thing, and obtains another, even though he saw and approved it with his own eyes. This is particularly true when the thing sold requires skill and knowledge to estimate it. Suppose someone were to buy the Duke of Wellington's cocked hat, and it turned out the purchaser obtained a cocked hat, but it was not the Duke's. No amount of examination of the hat could disclose whose it had once been, so that the maxim requiring a purchaser to look after himself does not apply. Still, purchasers will do well to be careful, if they buy stones. There are, it seems, stones in the market which the indulgent criticism of a seller may pass as diamonds, but which less interested authorities pronounce to be Cape stones, and worth less than a twentieth of the value of a Brazilian diamond.—*Morning Advertiser.*

QUERIES AND ANSWERS.

H.B.—The correspondent who offered to sell his Treatise on the Detached Lever Escapement, by Thomas Charles Scotchford, will please address H. Bush, Mytongate, Hull.

CONSTANT READER.—For 18 carat gold:

3½ parts fine copper.
2½ " " silver.
18 " " gold.

For 15 carat gold:

6 parts fine copper.
3 " " silver.
15 " " gold.

Best gold solder:

3 parts fine copper.
4½ " " silver.
12½ " " gold.

This should do for both qualities, but care would be required in using it for 15 carat.

Medium solder:

4 parts fine copper.
6 " " silver.
10 " " gold.

W. J. A.

W. J. A.—We presume that it is the sweepings containing gold and silver you wish to refine. Proceed as follows: To 8 oz. of the dirt, which has been washed and burnt, add salt, 4 ozs.; pearlash, 4 ozs.; red tartar, 1 oz.; saltpetre, ½ oz.; mix thoroughly in a mortar, melt in a crucible, and dissolve out the precious metals in a button. Mr. Edward Day, of 28, Warstone Lane, Birmingham, will give you *full* value.

W. S. B.—"New Weights and Measures Act" will be enforced after the 30th of June next. Copy of same will appear in our next.

NOTES ON THE PRIVILEGE OF "HALL-MARKING" CLAIMED BY THE GOLDSMITHS' COMPANY.

By Edward J. Watherston, F.S.A.

THERE is a famous line in Goethe's "Faust"—

> We inherit laws and privileges like an eternal disease,*

and I often think, in pondering on it, that the great German poet, in writing these words, must have had in view something akin to the laws and privileges of our world-famous old Goldsmiths' Company, dwelling in Foster Lane, under the shadow of St. Paul's. So much is certain, that if any one acquainted with the subject were called upon to prove the assertion of Goethe that there are, among civilised nations, laws and privileges which descend, from generation to generation, "like an eternal disease," he could scarcely find a better illustration than that of the wonderful franchises and privileges of the Goldsmiths' Company, dating many centuries back, and apparently immortal.

As is well known, all the companies and guilds of the city of privilege have their "time-honoured" privileges, derived from former English kings, and paid for in most instances; the sole reason for their being given existing in that our old sovereigns were always terribly in want of some ready cash, which could not be obtained in any other manner. Nearly the whole of these privileges are indefensible, but none more so than those obtained at various times by the Goldsmiths' Company. It is not in the least an exaggerated mode of expression to characterise them simply as monstrous. Probably no corporation that ever existed managed to wring such extraordinary prerogatives from needy kings, in times of their deepest distress, than the old Goldsmiths' of London. And the reason was simple enough. The goldsmiths, many of them from Lombardy and other parts of the Continent, were the earliest professional money-lenders in this country, their trade subsequently developing into banking. Whenever a king wanted any considerable sum of money, he had to go to the goldsmiths, there being no other body of individuals whatever, out of their own, able to raise an amount with which a foreign war could be carried on, or even an insurrection at home be suppressed. The goldsmiths, consequently, being monopolists in the money-lending business, charged high for their services, taking handsome bonuses besides, in the shape of charters granting them astounding privileges. There is no wonder that the charters, giving the keen money-lenders all that they asked for, were given; but the wonder of wonders is that these charters should be claimed as valid at the present day. It is true, some of the privileges extracted by the clever money-lending goldsmiths from insolvent kings have been tacitly given up, being too preposterous for assertion, but those that are still claimed are only a shade less absurd. At the head of them stands the grand and quite unique prerogative of the London Goldsmiths' Company, enjoyed, for a long time, as an absolute monopoly—though now shared, by recent legislation, with other "Goldsmiths' Halls" established at Edinburgh, Dublin, Birmingham, Chester, Exeter, Newcastle, and Sheffield—for the assay of all gold and silver ware manufactured in this country. Precisely in the same manner as sovereigns exercise the right of coining, so the Goldsmiths' Company of Foster-lane claim as their own that of "hall-marking."

The assay of gold and silver in this country is generally believed to have been originated by the Bishop of Salisbury, treasurer to King Henry I. The shrewd prelate, at his wits' end in the constant endeavour of raising fresh supplies for his master, imagined that something might be got by putting a stamp upon gold and silver ware, then made to a considerable amount in England. It was a very clever idea, in so far as that the stamp was not put forth in the light of a tax, but as a "protection." It was a "protection" alike for English industry and for the English people, said the good Bishop—and English industry and the English people appear to have believed him then, just as many persons believe it still. There seems great probability that at first the assay of gold and silver was not a compulsory but a voluntary impost. No law about it is to be found in the Statute Book, and the first enactment about it is in 1238, the twenty-second year of the reign of Henry III., when stringent regulations about assaying, and the fees to be paid for it, were made. The Act of 1238 was followed by another in 1270, the tenor of which shows that the tax invented by the Bishop of Salisbury had become a very profitable one, and to secure it new regulations were made, more severe than the former ones. Others followed in 1281, in 1300, in 1344, and in 1394, all tending to enforce and protect the assay-tax. So it went on till the reign of Edward IV., who, ever at war and ever in want, wasting blood and money with equal carelessness, soon got deeply into debt with the money-lenders of the City of London. Ready to sell everything of which he was possessed for immediate cash, he made over, in 1462, the second year of his reign, the assay-tax to the Goldsmiths' Company of London. By the charter of King Edward IV., the foundation of all subsequent ones which the shrewd and wealthy members of the company managed to obtain, they were invested with all the privileges formerly exercised by the English Government in assaying gold and silver ware and levying an impost thereon, not only in the City of London, but in all parts of the kingdom. That the basis of all their prerogatives should be derived from the grant of such a sovereign as Edward IV., one of the worst kings that ever disgraced the throne of England, forms by itself a curious commentary on the "time-honoured" privileges of the Goldsmiths' Company.

There is much evidence to show that the singular monopoly granted to the members of the Goldsmiths' Company under the charter of Edward IV. was exercised by them in the most oppressive manner. Numerous complaints arose on all sides, and they grew so loud under Henry VIII. that the latter monarch threatened, in 1545, to repeal the privileges of the company. The members thereupon lapsed into deepest humility. As told by Mr. Herbert, they "appeared before the Royal Council, and confessing they had offended in such things touching the assaying of gold and silver as they were charged withal, humbly desired to have the benefit of the pardon which the king had lately granted to his subjects." The applicants being told that "such pardon would not stand in effect in this matter," their humility fell to a quite abject state. Appearing again before the Council, they fell on their knees, "confessing their defaults, and offered in recompence [*sic*] thereof to surrender their incorporacion wholly into the king's hands, humbly praying his Grace that such foundation as had been ordained of their fathers and predecessors, upon their zeal and devotion, might continue according to their lordshipps' good myndys and entent." Secret negotiations followed, and in the end the king consented to restore the company their charter, on payment to him of a fine of 3,000 marks. When once more appearing before the Council, in July, 1545, a first instalment of the 2,000 marks—a very large sum of money for the time—having been paid, "the king's majesty's resolution was declared unto them, for the order of the fellowship in this mysterie, that they should use, as his Grace's ministers, the thyngs which they did before the surrender of their incorporacion, and innovate nothyng." It was ordered at the same time that for the future the Government would appoint two assayers, who, while paid by the company, should undertake the whole superintendence of the work, in an independent manner. This was no doubt to be a wholesome reform, but it had no effect whatever. Through the influence of the company, and, probably, by the ministration of fresh bribes, the worthy goldsmiths of London so managed that the two "masters and makers of assays and touche," appointed by the king were men who had not the least knowledge of the business. The one was a haberdasher and the other a grocer. The ingenious device thus come to has been perpetuated by the "honourable" Goldsmiths' Company to the present day. At this moment, in the governing court of the corporation, composed of twenty-five members, there are but four persons belonging to the trade, or knowing anything of it, the rest being altogether outsiders—among them an engineer, a porcelain manufacturer, and a stock-broker. This is in direct contravention of the original charter of the corporation, which ordered that it should be composed of "lawful, honest, and sufficient men, best skilled in the trade."

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* The original runs:—
"Es erben sich Gesetz' und Rechte wie eine ew'ge Krankheit fort."

Successive English kings were as open to bribes as Edward IV. and Henry VIII., and with their "golden keys" always to hand, the company not only kept all the old privileges well locked up, but gradually opened the doors to new ones. They thus amassed a whole pile of royal charters, altogether no less than fifteen. The edifice of charters thus gathered was crowned by one of King James II., given in the second year of his reign. It was the year when the last of the Stuart kings made his first open efforts to establish the Roman Catholic religion—efforts which before long cost him his crown—the introduction of priests and masses led to riots all over the country, and in his efforts to quell them, the king's treasury was soon completely empty. This was the time for the goldsmiths of London. They had got very wealthy, and were able to pay bribes far larger than those paid to King Henry VIII., and poor James II. was only too willing to accept all that was offered, finding the taxes not come in from his angry subjects, and his foreign priests very expensive. The upshot was, that the goldsmiths got all that they wanted in a royal charter granting them privileges which at the present time must be held absolutely monstrous. After setting out what his "most dear father Henry VIII., of famous memory," had done for the goldsmiths, likewise his "dear sister the Lady Elizabeth," and his other "dear sister the Lady Mary," King James declared his intention to fully confirm all the old grants and monopolies and to encompass them by new privileges. They were not a few. First of all, it was the royal will that the Goldsmiths' Company of London should possess not only the monopoly of assaying and taxing all wares of gold and silver, but also of articles of every description of jewellery. The words of the charter establishing this new monopoly were very precise. King James declared, for himself and his successors, that the company should have "for ever full power and authority over all and singular the defects, offences, faults and deceits, made and attempted, contrary to the ordinances of the mystery, in all their searches and trials of gold and silver, or of wares, jewels, stones, pearl, coral, or of any other jewels or counterfeit stones whatsoever. And not only did the charter give the company the sole privilege of assay, with a right to charge for it whatever they liked, but even the enormous power of committing to prison for an indefinite time. It was ordered by King James that all persons who either manufactured or exposed for sale what is now called "cheap jewellery," or Birmingham ware, "shall be, by the wardens of the said mystery of goldsmiths, committed to the next gaol or prison, therein to be punished by imprisonment of their bodies, according to the nature of their offences, and out of the said gaols and prisons to be delivered at the discretion of the said wardens." In order that there might be no mistake as to the new privilege of the Goldsmiths' Company to regulate the manufacture of "cheap jewellery" as well as of gold and silver ware, the charter of King James twice repeated the definition. "Wheresoever and as often," the charter went on, "as any wares of gold and silver, or of pearl, or of any counterfeit stones whatsoever, deceitfully wrought or set in the nature of jewels and pearls, in gold and silver which by the alloys thereof are of less value and more debased than in the working of gold and silver than of right they ought to be wrought, that is to say, not being of the value of sterling, or standard," the Goldsmiths' Company should have the power and privilege, besides imprisoning the makers and vendors of such "deceitful wares," to have the goods themselves destroyed. The officers of the company were invested with the fullest powers to order that all such ornaments, "wherever they shall be found," should be instantly either confiscated or annihilated—"to arrest, seize, break, and spoil them, so that our people may not be more deceived thereby." What would "our people" of Birmingham say if the Goldsmiths' Company were to try to put in force this part of the charter of King James II.? In all probability, the effort made would have the effect of at once upsetting the pile of the whole of their fifteen charters.

It is not worth while to dwell on various other privileges, all more or less monstrous, granted to the Goldsmiths' Company by the charter of the last of the Stuart kings. But there is one thing that may be pointed out in regard to this charter and many preceding ones. It is that the assay which the goldsmiths of London were empowered to make is nearly always called "the touch." There can be no doubt that this scientific way of testing the standard of gold and silver was formerly general in England, as it is still in all continental States. Shakespeare, in "King Richard the Third," says:—

> Ah, Buckingham, now do I play *the touch*,
> To try if thou be current gold indeed.

Between "the touch", or "examination by a stone," as defined by Dr. Johnson, and "the scrape and parting assay," now commonly practised at Goldsmiths' Hall, there is all the difference between science and barbarism. However, this is but part and parcel of the whole organisation under which the old company is allowed to tax and disfigure the produce of English manufacturing art and industry in gold and silver. It is a barbarism from beginning to end. Under its baneful influence the skill of the English craftsman, once famous all over the world, has sunk to the lowest level of art, and it is very nearly certain that artistic manufacture of gold and silver ware will become ere long entirely extinguished if allowed to languish and decay under the deadly shadow of the monopolies of Foster Lane.

MANUFACTURE OF ALUMINIUM IN GERMANY.

It has hitherto been thought that the aluminium manufacture was monopolized by France; but Mr. C. Bambery, in the annual report of the Society of Berlin Instrument Makers, stated that for some years past aluminium has been extensively manufactured in Berlin. Three firms especially (Stückradt, Häcke, and Schultze) are engaged in this branch of industry.

The articles manufactured principally are nautical instruments, as sextants, compasses, etc. The German navy is supplied throughout with aluminium instruments. As a proof of the superiority of German aluminium, it may here be mentioned that the normal sets of weights and balances used by the International Commission for the Regulation of Weights and Measures, which lately was in session at Paris, were obtained from Stückradt, in Berlin, and not from any of the firms at Paris, the reputed seat of the aluminium industry.

Aluminium is, in Berlin, generally used pure, and cast pieces only are composed of aluminium containing about five per cent. of silver.

ON THE COMPENSATION OF CLOCKS, WATCHES AND CHRONOMETERS.

By Edward Rigg, M.A.,
Assayer in the Royal Mint.

(*Continued from page* 137.)

NUMEROUS other combinations of two or more substances have been suggested from time to time, but detailed reference to them is unnecessary, since the principle of all is identical. J. L. Smith employed a vulcanite tube surrounding the lower extremity of a steel rod, in a manner somewhat analogous to Berthoud's pendulum, only that the tube passed up within the (copper) bob; Ley used zinc and glass similarly arranged; and Callaud proposed a combination, in which steel, brass, and platinum (wire) are used. The brass tube resting on the timing nut supports a plate at its upper end, through which pass two screws attached to the extremities of a platinum wire. This passing round a groove in the pendulum bob, raises it as the brass tube expands, and the adjustment for compensation somewhat resembles that of Jacob's pendulum. Benzenberg's pendulum, as modified by Kater, consists of a lead tube traversed by an iron wire, the bob being suspended by two iron wires from the upper end of this tube. By employing deal and zinc, Kater succeeded in reducing the length of compensation metal so as to conceal it within the bob; and Baily, in his celebrated paper on "Compensation," proposed a cheap construction, in which the upward expansion of a cylindrical lead bob neutralised the downward expansion of a deal rod.

According to Short, compensation by means of levers was suggested by Graham, but abandoned in favour of mercury. In the hands of Ellicott, it gave some very good results, and an excellent specimen of this form of pendulum may be seen in the hall of the London Institution. The rod consists of a brass bar enclosed between two flat steel bars, but all three are free to expand independently downwards, being rigidly fixed at their upper ends. The bob is free to move on the rod, and is hollowed out in its centre, to receive the compensation mechanism. The brass bar presses on a loose steel pin, which, by means of an intermediate brass piece, actuates two horizontal levers, centred on the steel of the pendulum rod. The bob is supported at the extremities of these levers, and, since the expansion of brass is greater than that of steel, it will be evident that any change of temperature will thus cause the bob to rise or fall; by varying the points at which the bob is supported, the extent of this motion may be altered, and thus the compensation adjusted.

In pendulums of more modern construction, the three rods are separate, having the appearance of a gridiron, with steel in the middle and brass or copper on either side. A horizontal right and left-handed screw is held in a stud on the middle rod, and engages in studs in the external rods, and thus, by a slight rotation in either direction, the length of the acting arm of the lever, and, therefore, the degree of compensation can be varied. A pendulum working on the lever principle was patented by the celebrated engineer, Richard Roberts, of Manchester, but it does not seem to have been employed.

Lastly, an ingenious contrivance by Tremeschini should be mentioned, as it acts on an entirely novel principle, although levers are used. The rod consists of two detached bars of copper and steel, fixed at their upper ends, and bent at an angle backwards, so that the centre of gravity of the bob, which is supported on a horizontal arm, may be directly below the centre of suspension. This arm is pivoted at the extremity of the copper rod, the steel being bent a second time, and pivoted at a point a few inches in advance, while the bob can be moved horizontally by means of a nut.

The forms of pendulum that are included in Class III. are almost as numerous as those which have the gridiron for a type. They are all based on the following fact. If, at a certain mean temperature, strips of two metals of different expansibilities—such as steel and brass—are rigidly united in the form of a straight rule, then an increase of temperature will cause the pair to bend with the more expansive (brass) outwards, and, on a fall of temperature, the converse will be the case. The reason for this fact is so obvious as hardly to require explanation. Although both metals expand, the steel, relatively to the brass, will contract in heat.

Brass and steel are nearly always employed in conjunction, and the combination may be made available for compensation in three ways: (1) raising and lowering the entire pendulum, by being attached to the suspension spring or thread, which passes between two edges near together, a plan adopted by Destigny for small clocks, (2) moving one or more auxiliary weights to or from the centre of suspension, (3) by moving the entire bob in a vertical direction, as is done in Cole's pendulum. It is strange that, while nearly every compensation balance involves the use of bi-metallic strips, the device is very rarely applied to pendulums, although the second mode of employing it seems, at any rate, to afford good means of effecting the final adjustment of the compensation. The great merit of the system is that the motion is continuous, and not step by step, as in the two classes previously considered.

A curious arrangement, involving the use of bi-metallic strips, was patented in 1840, by Dent, and deserves mention. He proposed to communicate the impulse to the pendulum at its centre of percussion, and two arms projected from the escapement, placed below the pendulum, on either side of the bob for this purpose. Two U-shaped compensation strips were attached to the bob, and received the impulse from these arms; on heating, the pendulum lengthened, the strips moved outwards, and were therefore struck with greater rapidity, since the arc of vibration was diminished; thus the loss occasioned by the expansion of the rod was counteracted.

In 1855, Merceron showed at the Paris Exhibition, a pendulum in which the effect of temperature was avoided by forming the rod of a series of bi-metallic strips arranged alternately; it is only necessary to point out that the brass is on an equal number of concave and convex sides, and thus the position of the bob, which is supported at its centre, remains unchanged, since one bend will tend to close to the same distance as the next tends to open.

The only other application that remains to be noticed was proposed by the Astronomer-Royal, for effecting the final adjustment of the compensation, and adopted in the Greenwich sidereal clock. Two small straight bi-metallic arms, carrying weights, are held friction-tight on the crutch axis, and by varying their inclination, it is possible to alter the vertical distance, through which their common centre of gravity is moved on a change of temperature. This motion is anticipated to produce the requisite change in the rate of the clock, but it has not yet been found necessary to bring it into action.

We now come to the fourth and last class of pendulums, those in which mercury is employed. Graham first advocated its use in 1722, and the pendulum has only undergone slight modifications since his day. The form ordinarily met with in regulator clocks consists of a steel rod, terminating in a stirrup of the same metal, which carries a glass cup of mercury. When the temperature rises, the steel becomes longer, but the volume of the mercury increases, and since its expansion is greater than that of glass, its level rises, and there is thus a tendency to maintain the position of the centre of oscillation constant. Obviously, a certain volume will exactly suffice to maintain it stationary, and the pendulum will then be independent of temperature. There is some difficulty in introducing the mercury without carrying down bubbles of air, and M. Fenon recommends the use of a long glass funnel, reaching to the bottom of the vessel, for this purpose. Two principal objections have been urged against the mercury pendulum; the glass vessel, being a very poor conductor, makes the metal it contains change temperature much less rapidly than does the steel rod, and the compensating metal, mercury, is not necessarily at the same temperature as this rod. Several makers have attempted to avoid the first-mentioned difficulty by distributing the mercury through two or more vessels, but this practice increases the difficulties of adjustment. A more convenient method is to replace the glass by an iron vessel, and prolong the rod into the mercury; in this case it is also possible to expel air from the metal by boiling *in situ*. Laugier made experiments with a view to ascertain the most convenient diameter of the vessel as compared with that of the rod (of iron), a proportion which of course is dependent on the specific heat and conductivity of the metals. He finds that the iron jar should be four times the diameter of the rod, and he further states that in pendulums of the first two classes the diameters of iron, copper, and zinc rods should be to each other in the proportion 100, 135, 109.

In comparing the several kinds of pendulums, it is to be observed, that most of the forms included in the first two classes are equally satisfactory for a change in the temperature of the entire length of the rod, or for only a portion of its length, but this is not the case with the third and fourth classes. Now, the temperature of a clock-case, with seconds pendulum, may vary as much as 3° or 4° Centigrade, and in such a case the mercury or bi-metallic compensation would not be brought into action, although the rod would certainly be lengthened. This is the principal reason urged against Graham's pendulum by the French makers. They prefer the gridiron, which is objected to in England, on account of the great number of contacts, and the consequent non-continuous action of the compensation (a criticism which also applies to lever pendulums), the expense of its construction, the weight of the upper portion of the pendulum, and the pressure on the upper ends of the compensating rods. Mercury is, however, being now gradually discarded in favour of the gridiron principle, as applied in such pendulums as that of Dent, which has often been found to give more uniform results than the mercury pendulum. But Sir W. Thomson, who has studied the question of compensation in connection with his new design of astronomical clock, concludes that the use of steel rods is a mistake, as the pendulum rod should be formed of a substance having the least possible expansibility, such as glass or platinum. Mercury, having a high specific gravity and expansibility, should be the other in preference to lead, unless the capillary uncertainty of its surface is found to occasion irregularities in the rate. He is, therefore, applying to his tide-gauges pendulums formed entirely of glass and mercury, with rounded agate knife edges, and anticipates that the error will be found to be not more than one-tenth that usually observed, and he points out that, if these precautions are not sufficient, it will be necessary to enclose them in an air-tight case, at constant temperature. It is interesting to compare this latest form of compensation with that invented just 50 years ago by Robert, which in great measure satisfied the conditions laid down by Sir W. Thomson.

Barometric Variations.

Let us now pass to the means adopted for counteracting the effects produced by variations in the atmospheric pressure. Baily, in his celebrated paper read before the Royal Astronomical Society in 1823, seems to have been the first who drew the attention of astronomers to this source of irregularity, and the researches of Bessel and Sabine threw much light on it. Dr. Robinson, in 1833, proposed to attach two light barometer tubes, filled with mercury, on either side of the pendulum rod; the effect of which would be that whereas, on the barometer rising, the increased resistance due to the friction, &c., would tend to occasion a loss, the fact of a small quantity of mercury rising towards the centre of suspension, in consequence of the rise in the barometer, would neutralise this effect. The amount of the error that has to be corrected has been variously estimated by different observers at from 0·42″ to 0·23″ per 24 hours for each inch rise or fall of the barometer, but, as Baily pointed out, it depends on the arc of oscillation of the pendulum. For in a circular pendulum the period of the long arcs is slightly greater than that of the short arcs; if, therefore, at the normal pressure, the pendulum describe a given arc, any increase of pressure would oppose a greater resistance, and, the arc being slightly diminished, its period will be increased. A point must exist at which these two influences neutralise each other, and Baily calculated it to be 2°·45′, a result which has been confirmed by the experience of the Westminster clock, as this is found to show no variation to correspond to changes in the barometer. Experiments by Dr. Hipp, at the Neuchâtel Observatory, lead him to the conclusion that this effect of the air, however, is not a simple modification of the amplitude, and that the irregularities observed are caused by the escapement, suspension spring, &c., a view which is also held by Redier. Several attempts have been made to avoid this source of error by enclosing the clock in an exhausted space, and Redier and Hutton attempted to enlarge or contract the air space of the pendulum. Only two systems are in practical use, namely, that proposed by the Astronomer Royal, and applied to the sidereal clock at Greenwich, and the very elegant arrangement adopted by Redier.

In the former the active force of gravity is supplemented by that of a small permanent magnet, so arranged that its distance from the pendulum bob varies with every rise and fall of the barometer. The magnet is suspended from one extremity of a short balance beam, while the other end carries a pendant, terminating in a steel disc which floats on the surface of the mercury in a syphon barometer. Two bar magnets are fixed to the pendulum bob, at a mean distance of 3¾ inches from the magnet, and the short arm of the barometer has twice the diameter of the long arm, so that a fall of one inch moves the magnet half an inch farther from the magnets.

Redier adopted an extremely simple device, which he states to be perfectly efficacious and can be applied to any pendulum. To a transverse bar the exhausted box of an aneroid barometer is fixed, and a weight is attached to the under side. If, now, the atmospheric pressure increase, the weight will be raised in consequence of the contraction of the box; and it is obvious that, when this weight is properly adjusted, its motion will so alter the position of the centre of oscillation as to counteract the loss or gain caused by barometric variations.

(*To be continued.*)

A blue sapphire of marvellous size has been recently found in the gem district of Ceylon; it weighs two pounds in the rough, and was discovered by two boys, who, not aware of its nature, sold it for a trifle.

A French provincial watchmaker exhibits the following announcement to the public:—"New Patent System.—Watches repaired in 24 hours by a mechanical process." Some of his less clever fellow craftsmen insinuate that the "mechanical process" is simply an application of the shoeblacking machine shown at the Paris Exhibition.

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PATENTS.

Applications for Letters Patent.

1322. ANTOINE LÉON CORNU, Watchmaker, of 3, Bennett Street, Fitzroy Square, in the county of Middlesex, for an invention of "Improvements in the means of manufacturing chimes in clocks."—Dated 3rd April, 1879.

1397. HERMANN KRUPP, of Vienna, Austria, for an invention of "Improvements in or preparatory to electro-plating."—Dated 8th April, 1879.

1403. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for an invention of "Improvements in watch cases."——A communication to him from abroad by Ezra C. Fitch, of New York city, in the United States of America.—Dated 8th April, 1879.

Patents which have become Void.

1445. RICHARD WEDERMANN, of Princes Street, in the county of Surrey, Civil Engineer, for an invention of "Improvements relating to the extraction of gold, silver, and other metals from ores and other substances, and in apparatus therefor, which apparatus is applicable for other purposes."—Dated 5th April, 1876.

1529. JOHN COMPTON WEEKS JEFFERYS, of 14, Tottenham Court Road, in the county of Middlesex, Manufacturing Jeweller, for an invention of "Improvements in scarf-rings and other like dress fastenings and ornaments."—Dated 11th April, 1876.

Grants of Provisional Protection for Six Months.

1117. To WILLIAM ROBERT LAKE, of the firm of Haseltine, Lake and Co., Patent Agents, Southampton Buildings, London, for the invention of "Improvements in the manufacture of goldplated metal, and in articles made thereof."—A communication to him from abroad by Lucien Joseph Falize, jun., of Paris, France, Goldsmith and Jeweller.

1191. And to THOMAS SOUTHGATE, of Burton Crescent, in the county of Middlesex, Gun Maker, for an invention of "Improvements in the construction of wrist and other studs or solitaires."

Patents Sealed.

4085. PIERRE ZÉPHIR STÉPHANE BULOT, Jeweller and Chain Manufacturer of the City of Paris, in the Republic of France, for an invention of "Improvements in studs and buttons for shirts, cuffs, and wearing-apparel."—Dated 15th October, 1878.

4069. THOMAS WINKLES & THOMAS MOXON, both of Birmingham, in the county of Warwick, for an invention of "Certain improvements in swivels for securing watches to their chains, also applicable to other analogous purposes."—Dated 14th October, 1878.

Patents Granted in Foreign States.

GERMAN EMPIRE.

4739. F. C. J. MÜLLER, of Lohne (Oldenburg), for "An alarum."—Dated 5th May, 1878.—Class 74.

4748. A SAUER, of Mühlheim-on-the-Ruhr, for "Improvements in alarums."—Dated 30th August, 1878.—Class 83.—Addition to Patent No. 4141.

4923 A. BOHMEYER, of Cönnern, for "Modification in Pendulum-clocks."—Dated 13th September, 1878.—Class 83.

5016. D. A. A. BUCK, of Worcester, for "Modification in watches."—Dated 30th June, 1878.—Class 83.

5078. F. W. BÉTAG, of Berlin, for "A lock for securing watches."—Dated 1st September, 1878.—Class 44.

BELGIUM.

47,522. G. THOMMEN, for "Improvements in pocket-watches."—Dated 25th February, 1879.

FRANCE.

126,555. BELZON, of Montpellier, for "Economical clocks."—Dated 23rd September, 1878.—Class 12.

126,612. MARCHIVE & Co., for "Spring-blades for the suspension of clockwork."—Dated 20th September, 1878.—Class 12.

126,673. FROMENT, for "A universal lathe for clockwork."—Dated 24th September, 1878.—Class 12.

126,722. MAIROT, for "A universal watch for all meridians."—Dated 27th September, 1878.—Class 12.

AUSTRIA.

3201. J. F. ROZANEC, of Budweis, for "A pendulum-clock striking the quarters without special clock-work."—Dated 4th November, 1878.—Class 7.

3252. A. ULLMANN, of Paris, for "A remontoir for clocks."—Dated 4th November, 1878.—Class 7.—French Patent, 8th May, 1877.

UNITED STATES OF AMERICA.

212,297. JAMES N. ALLEN, of Providence, R.I., assignor of one-half of his right to Calvin Stone, of the same place, for "An art of making ballheads of scarf-pins, &c."—Application filed, 4th January, 1879.

212,692. CHARLES HEIN, of Corona, N.Y., for "Bracelets."—Application filed 7th January, 1879.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

BIRCH, WM., Granby St., Leicester, watchmaker. Apr. 5. Wright & Hincks, sols., Leicester.

BROWN, JSPH., St. Silas's Sq., Lozells, Aston, Birmingham, jeweller. Apr. 2. Tyndall, Tyndall & Deakin, sols., 34, Waterloo St., Birmingham.

BUTCHER, EDWD, Clifton Ter., Beckenham, watchmaker. Mar. 29. E. W. Owles, sol., 22, Chancery Lane.

DILGER, JNO. W., South St., Park, Sheffield, jeweller. Apr. 7. West & Styring, sols., Sheffield.

HOWES, JSPH., & ALFRED JSPH. HOWES, trdg. as JSPH. HOWES & SON, Macdonald St., Sherlock St., & Pershore Rd., Birmingham, electroplaters. Apr. 2. Buller & Bickly, sols., Bennett's Hill, Birmingham.

HOWES, JOSEPH, Macdonald St., Sherlock St., & Pershore Rd., Birmingham, electro plater, (sep. crdtrs.) Apr. 2. Buller and Bickley, sols. Bennett's Hill, Birmingham.

LEWIS, JOHN, Queen St., Tredegar, jeweller, &c. Apr. 2. At J. A. Shepard, sol., Tredegar.

STOKES, HENRY, Albion St., Birmingham, jeweller. Apr. 1. W. Fallows', sol., Cherry St., Birmingham.

WILSON, WM., Horsehay, Dawley, Salop, watchmaker, &c. Apr. 4. Phillips, Osborne & Phillips, sols., Shifnal.

BURROW, ROBT., tdg. as R. BURROW & Co., 9, Hatton Gdn., & 30, Arlington Sq., Islington, watch imptr. Apr. 16. G. W. Naunton, sol., 58, Cheapside.

Darling, Adolphus, 163a, Mile End Rd., jeweller. Apr. 7. Nutt & Savery, sols., Brabant Court, Philpot Lane.

Davies, Ismael, Llanberis, dlr. in watches, &c. Apr. 7. M. Owen, sol., Carnarvon.

Farrer, Alfd., Promenade Villas, Cheltenham, watchmaker. Apr. 9. F. Stroud, sol., Cheltenham.

Lee, Wm., Bideford, jeweller. Apr. 10. Hole & Peard, sols., Bideford.

Alton, Isaac, Sussex St., Middlesborough, jeweller. Apr. 16. Hodgson & Haigh, sols., 13, Waterloo St., Birmingham.

Howard, Geo., Bedale, York, jeweller. April 19. At Thomas Hotel, York, May 7, at 1. L. S. Thompson, sol., Richmond.

Norris, Wm., Newport, Salop, watchmaker, gun maker & optician. Apr. 17. At B. H. Smallwood's, sol., Newport, May 5, at 12.

Schriber, Christpr., Dalton-in-Furness, watchmaker. Apr. 17. At Wellington Hotel, Dalton, May 5, at 1. J. H. Pinckney, sol., Barrow-in-Furness.

Schuler, Wilhelm, Geraldine Rd., Wandsworth, & Poland St., Oxford St., jeweller. Apr. 16. J. S. Kisch's, sol., 7, Argyll Pl., Regent St.

Payne, Wm., High Holborn, dealer in fancy goods, & trdg. as Payne & Son, at Lowndes St., jwller., (sep. crdts.) Apr. 24. At Cannon St. Hotel, Cannon St., May 15, at 3. Gush & Philips, sols., 3, Finsbury Circus.

Syson, Arthur, Jas. & Ruth Syson, Newhall Hill, Birmingham, late Tipton, importers of Geneva watches & jewellers' factors. Apr. 23. At R. J. Parr's, sol., Colmore Row, Birmingham, May 9, at 11.

Trustees Appointed.

Lowry, James (Liq.), Ardwick, Manchester, watchmaker, Tr., W. Pooke, Princess St., Manchester, accountant.

Steiner, Leon, & Alex. Stoessiger (Liq.), 64, Hatton Garden, watch importers, Tr., Seear, 23, Holborn Viaduct, accountant.

Bowen, John (Liq)., Glasshouse St., Regent St., watch-maker. Tr., W. Johnson, Sackville St., Piccadilly, hat manufctr.

Adjudications of Bankruptcy.

Thomas, John, Penygroes, Carnarvonshire, jeweller. Apr. 3. At C. C. Bangor, Apr. 23, at 3. Jones, Reg.

Hunt, John Wm., Jas. Hny. Hunt & Wm. Benj. Reynolds, jun., trdg. as Hunt, Reynolds & Co., Wolverhampton, silversmiths. Apr. 21. At C.C. Wolverhampton, May 7, at 2. Sanders, Reg.

Dividends.

Draper, Jas. (Liq.), Stowmarket, silversmith. 1st div. 10/-; F. Fox, Coddenham, Suffolk, or H. Atkins, 4 Thavies' Inn, London.

Payne, Wm. (Liq.), Queen Victoria St., & Highbury New Park, jeweller. 1st div. 6/-; May 7 and three following Wednesdays between 11 and 2; Webster & Banes, at Steer & Knights, 22, Basinghall St.

Scotch Sequestrations.

Spitz, Gerhard, 24, Sandport St., Leith, watchmaker, sole partner of Spitz & Rombach, and as an individual. Apr. 17, with protn. Tr. & Com. Baltic Hotel, Commercial St., Leith, Apr. 26, at 2. Clms. by Aug. 17.

Trustees and Commissioners Appointed.

Littlejohn, Wilson, King St., Stirling, watchmaker, &c., Tr., J. Miller, 71, Queen St., Glasgow. Com., P. C. Hutcheon, writer, W. Coghill, Queen St., & W. Smith, 25, Queen St., all Glasgow.

Muir, Geo., Jamaica St., Glasgow, jeweller. Tr., R. Reid, 40, St. Vincent Pl., Glasgow. Com., T. Muir, & R. Scott, both Trongate, Glasgow.

Dividends under Sequestrations.

Mackay, Cunningham & Co., Princess St., Edinburgh, jeweller, &c. 6/- per £. J. W. Guild's, Glasgow, acctnt., forthwith.

INQUIRIES CONCERNING PATENTS.

Inquiries made relating to British and Foreign Patents Specifications and Drawings of Inventions Supplied. Strictly Confidential. Fees moderate.

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PRESERVATION OF IRON.

Captain Bowden has devised simple forms of apparatus for coating iron with Barff's magnetic lacquer. In the course of his experiments he found that the coat of oxide could be formed by the air in the following manner: The serpentine part of a sheet iron reservoir communicates with air which is heated to 248° F. The current of hot air, after circulating through the serpentine, reaches the cylinder which contains the articles to be lacquered. The escape spout communicates with a water aspirator regulating the flow of air, which should be very gentle. The internal pressure is little more than one atmosphere, the apparatus being in communication with the open air. The temperature of the air in the cylinders is 536° F.; the operation lasts five hours, giving a coat 0·05 of a millimetre thick (0.002 inch), of a beautiful greenish black, resisting the action of fine emery paper and of dilute sulphuric acid. After the articles are taken from the cylinder, they are rubbed with a greasy rag, and spots are removed by very fine emery paper or scouring glass. Spots may generally be avoided by suspending the pieces, so that they will not touch each other or the walls. If the temperature is raised to about 572° F., a thick coat is secured, but it is apt to scale. Articles thus lacquered have been exposed to snow and rain for a month without getting any spots of rust. If the black coating is removed by emery paper, there is a greyish layer on which rust does not take much hold; the spots can easily be removed by a bit of hard wood. Barff has observed the same peculiarity in articles which have been steam lacquered.—*Annales des Ponts et Chaussées.*

To WATCH AND CLOCKMAKERS.—A young man, with several years' experience in the jobbing business, seeks employment. Well recommended. Address: Mr. Bordes, 174, Carlton Road, Kilburn, N.W.

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BRONZES.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 140.)

WE know by observation and written record that subsequent to the period, varying in different countries, when the use of stone weapons and implements was general, the art of fashioning metals gradually spread. It is reasonable to presume that the native metallic copper found in various places, was first brought into application, and that from the fact of that metal requiring a very high temperature to fuse, and the more complicated arrangements necessary for casting, the earlier method of working it into shape was by cold hammering; this was subsequently assisted by previous heating. Accordingly we find that some of the tribes of North America, in the District of Lake Superior (although able to rend the rocks by fire in order to extract the flakes of metal, and to sink shafts and workings where native copper occurs in large masses, but unacquainted with the art of fusing and casting) were in the habit of fashioning the metal thus found ready to their hands into various instruments by cutting and by cold hammering. In Ireland, India, Cyprus, etc., weapons of copper, cast or beaten, have been found of simple forms, analagous to those of the stone implements, the use of which preceded, or was contemporaneous with them. Some of these, whether fashioned by the hammer or cast in moulds, have been proved to contain a small quantity of tin, which may or may not have been an accidental addition. How the admixture of tin with copper to produce bronze was first discovered, and where, are problems which we can hardly expect to solve; but it is a remarkable fact that scarcely could our present scientific knowledge suggest an improvement in the general composition, or our advanced mechanical practice surpass the admirable workmanship and beautiful form of the various implements, of the developed bronze period. Their more usual composition is of nine parts of copper to one of tin; but the proportion of the latter metal occasionally varies, as might be expected, from five to fifteen per cent.; and in some of the later specimens some lead has been detected.

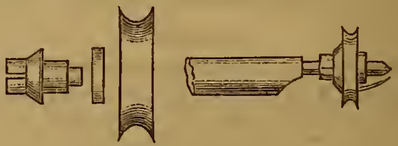
As far as our present knowledge will enable us to infer, it would appear probable that the Caucasus was the cradle of the bronze industry and civilisation; thence, as from a watershed, it flowed in one direction, southward and westward, through Greece and the Mediterranean Islands to Italy; perhaps to Cyprus by Phoenicia; in another by the Danube, through Hungary and Northern Germany to the Baltic, whence it may have spread to Sweden and Norway. At a very remote period bronze attained to a high degree of perfection in Greece and in Etruria, probably anterior by several centuries to its spread in Germany. Gaul, and perhaps Britain, may have received it from the North, unless we may suppose that, as is equally probable, a native English development was prompted by the abundant possession of the requisite ores. Indeed it may not unreasonably be presumed that various sources of the art existed, springing from these districts where copper and tin ores were native, and differing in period proportionately with the development of their respective civilisation. The use of bronze for cutting instruments as preceding the knowledge of iron is referred to by Hesiod, by Lucretius, by Agatharchides, and other ancient writers, and proved by modern research. In Egypt the use of iron was known in very early times, and iron instruments have been found, together with those of bronze, such as daggers, axes, swords, etc., of characteristic forms peculiar to that country. One of these, a flat axe blade of bronze, is inscribed with the name of Pa-'hek-aa, supposed to be one of the shepherd kings. So also in Assyria, bronze occurs in company with implements and weapons of iron, the latter being more numerous; and in Babylonia also. Bronze weapons were often unearthed during the excavations made in Cyprus by General di Cesnola and Mr. Lang; and it is remarkable that many of these were made of nearly pure copper, perhaps by hammering only, as the sockets are formed by beating round a central form. The bronze weapons discovered by Dr. Schliemann at Hissarlik, the supposed site of ancient Troy, are finely shaped by casting. Rhodes has yielded others at Talysus, assumed to be 1200 years B.C. In the Caucasian plains a large quantity of bronze arrow-heads of Grecian type has been discovered. The copper implements of India have already been referred to; of these the great hoard of 424 pieces discovered in 1870 near Gungeria, in the Balaghat district of central India, is perhaps the most noteworthy. Some few others of bronze have been found elsewhere in India, and also in Persia, in Burmah, in Java, and in China. Siberia has a few, and perhaps every country of Europe has given us specimens in more or less abundance; Greece and Italy, France and Switzerland, Germany, Hungary and Sweden, having their more or less peculiar and characteristic examples of nearly every variety of cutting or pointed instruments, weapons, tools, and personal ornaments. Implements of copper have also been found in Peru.

(*To be continued.*)

CORRESPONDENCE.

TO THE EDITOR OF THE WATCHMAKER AND JEWELLER.

Dear Sir,—I would draw the attention of watch jobbers to one of the most useful tools I ever had the pleasure of using. As we are all aware, balance staff pivots are very often slightly injured and require the least bit of rounding up, and owing to the trouble of taking off roller and hair spring, and fastening on either screw or wax collet, they are often left, or touched up with a burnisher in the hand. The accompanying sketch will speak for itself, but instead of one carrier pin, I use two that will just take the arm of a chronometer balance between them. Where you have a heavy balance with light pivots there is danger with one pin, but with two none in the least. I have supplied it to my Jacot tool, and use it for repairing pivots, from the smallest Geneva to the heavy chronometer balance. If the carrier pins are made flat at the ends they will pass through the hair spring of a spring under balance to catch the arm without doing the spring the least harm.



Drill a hole in the centre and fix a steel arbor as shown. Make a collet of good hard brass to slide easily on arbor, with a slit cut across, so that when pinched it can be moved, and yet remain tight enough for use. The ferrule should be of steel with little friction, and a small washer fitted tightly on the end and riveted over. Two carrier pins in the ferrule. The carrier pins in sketch are rather too much curved, and thus brought too near the centre.

H. Willson.

Manchester.

TO THE EDITOR OF THE WATCHMAKER AND JEWELLER.

Sir,—I shall feel much obliged if some of your readers will give their experience of the various descriptions of watches manufactured in Switzerland. Residing in a small country town, the only class of Swiss watches offered to me are the ordinary horizontals, a movement fairly well finished, but whose time-keeping qualities cannot be considered satisfactory.—Yours, &c.

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